XXXIII Simposium Nacional de la Unión Científica Internacional de radio

URSI 2018

5, 6 y 7 de septiembre de 2018
Palacio de Congresos
Granada

Granada
XXXIII SIMPOSIUM NACIONAL
URSI 2018

Granada

XXXIII SIMPOSIUM NACIONAL

URSI 2018

ORGANIZA

UNIVERSIDAD DE GRANADA

PATROCINAN

KEYSIGHT TECHNOLOGIES

ROHDE&SCHWARZ

CST joins SIMULIA

Vista panorámica de Granada con Sierra Nevada al fondo.

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Pablo Padilla de la Torre, Juan Valenzuela Valdés, Pablo Muñoz Luengo, Ángel Palomares Caballero, Luz García Martínez, José Luis Padilla de la Torre, Antonio Palomares Bautista, Francisco Javier García Ruiz y Jorge Navarro Ortiz

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BIENVENIDA

Dr. Pablo Padilla

Dr. Juan Fco. Valenzuela

Es para nosotros un honor poder darles la bienvenida al XXXIII Simposium Nacional de la Unión Científica Internacional de Radio (URSI), organizada en el seno de la ETSII Telecomunicación de la Universidad de Granada. Esta edición de 2018, celebrada en el Palacio de Congresos, se desarrolla en la ciudad de Granada, ciudad en la que pasado, presente y futuro se dan la mano al pie de Sierra Nevada. Además, es una satisfacción adicional tomar el testigo de la memorable edición URSI-Granada de 1985, dando continuidad a este foro de encuentro anual de colegas en el apasionante ámbito de investigación del electromagnetismo, la radiofrecuencia y las antenas.

El Comité Organizador ha trabajado duro para crear un programa científico y sociocultural que sirva de marco para la difusión de conocimiento científico, el intercambio de ideas y el desarrollo de oportunidades de colaboración entre los asistentes. Dirigido tanto al ámbito académico como profesional, el congreso tiene, además, un compromiso especial con los estudiantes que inician su etapa investigadora. En él se presentan los últimos avances científicos de nuestra comunidad, en sus diferentes ámbitos. El programa científico resultante de la presente edición es amplio (210 contribuciones), diverso (38 sesiones temáticas) y de gran calidad técnica. Contamos con sesiones ordinarias y sesiones especiales, tres conferencias plenarias invitadas, así como workshops y presentaciones por parte de los patrocinadores del evento.

El programa científico se complementa con una serie de actividades socioculturales que nos permitan compartir con los asistentes un pedacito de la vida en Granada: Cóctel de Bienvenida en el Carmen de los Mártires y visita guiada a La Alhambra, así como visita guiada al Albaicín y Cena de Gala en el Carmen de los Chapiteles.

Esperamos que disfrutéis de la presente edición URSI 2018 en Granada.

Un cordial saludo,

Pablo Padilla de la Torre y Juan Francisco Valenzuela Valdés

Presidentes del Comité Organizador URSI 2018

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ORGANIZACIÓN

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INFORMACIÓN GENERAL

UNIVERSIDAD DE GRANADA

La Universidad de Granada (UGR) se funda en 1531, dando lugar a la principal institución académica del Renacimiento cuyos orígenes se remontan al siglo XIV, cuando Yúsuf I crea la Madraza de Granada.

En la actualidad, el liderazgo de la UGR queda reflejado en el reconocimiento como una de las mejores instituciones educativas según varios rankings. Así, aparece clasificada entre las 300 mejores universidades del mundo y la segunda de España, según el *Shanghai Academic Ranking of World Universities*.

Hospital Real, Sede del Rectorado de la Universidad de Granada

La UGR está fuertemente comprometida con una gestión eficaz y eficiente, con el conocimiento, su transferencia y con la innovación docente y la calidad de sus servicios. El liderazgo en investigación, la mejora constante de su actividad a través de las TIC, la internacionalización y la igualdad de oportunidades son también señas de identidad de la UGR.

Desde su fundación, la UGR ha jugado un papel clave en el crecimiento de la ciudad, definiéndola tanto desde un punto de vista arquitectónico como cultural y económico. Los cinco campus de la UGR, además de otros centros aislados, se diseminan por toda la ciudad, dándole un ambiente indudablemente universitario. Además, hay otros dos campus en el norte de África, en las ciudades autónomas de Ceuta y Melilla

A nivel internacional, la UGR recibe cada año más de 2000 alumnos procedentes del programa Erasmus, lo que la convierte en el primer destino europeo dentro de este programa de movilidad. Además, ha sido elegida la mejor universidad de España por los estudiantes internacionales.

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍAS INFORMÁTICA Y DE TELECOMUNICACIÓN

La Escuela Técnica Superior de Ingenierías Informática y de Telecomunicación (ETSIIT) es un centro docente de la Universidad de Granada situado en el campus Aynadamar, dedicado a la docencia e investigación en los estudios relacionados con la informática, las ciencias de la computación y las telecomunicaciones.

La titulación de Ingeniería Informática se comienza a impartir por primera vez en 1986 en la Facultad de Ciencias. Posteriormente, en 1993, se le otorga a dicha titulación una sede propia.

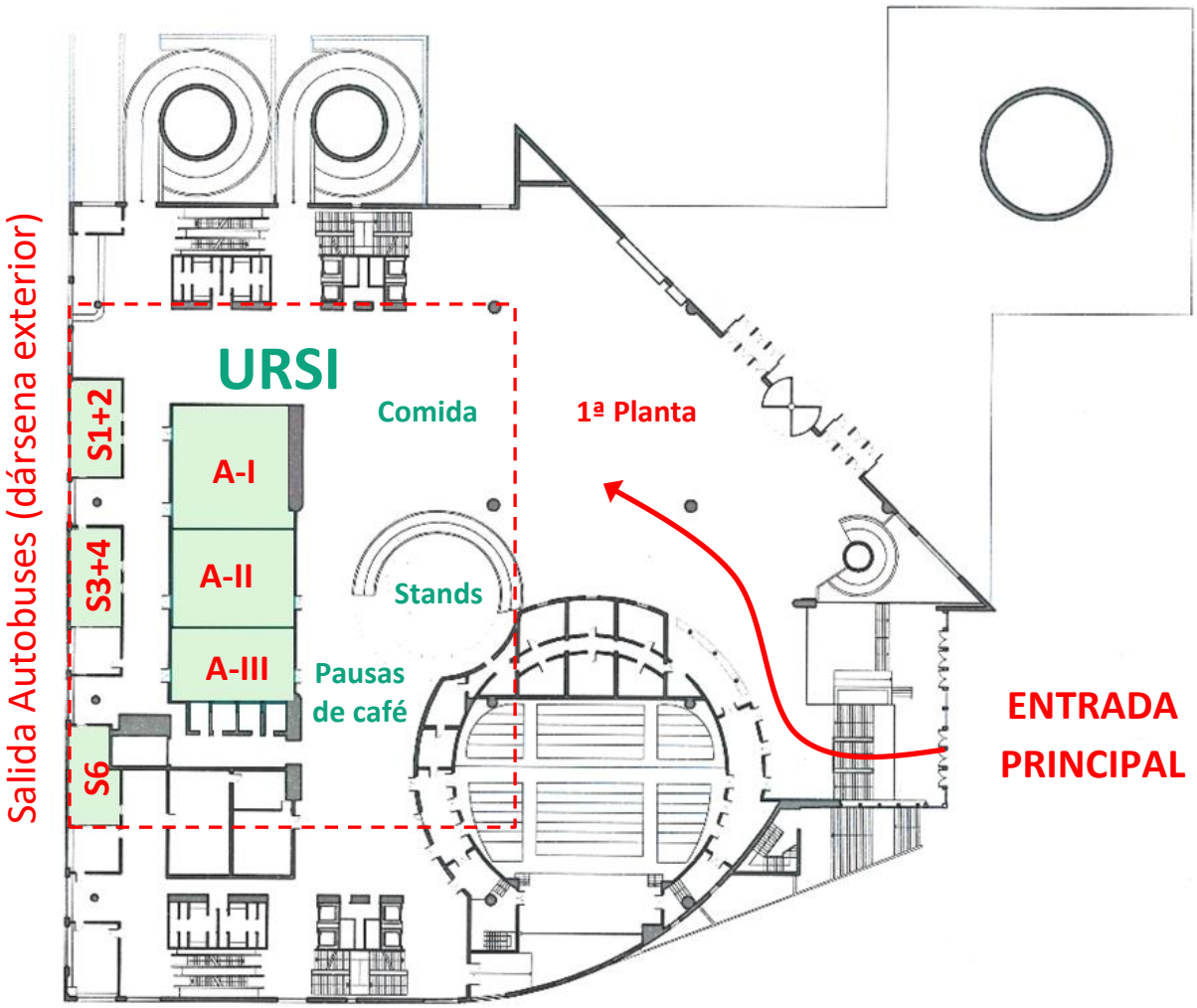
ETSIIT-UGR

En 2002, el gran crecimiento en el número de alumnos y profesores, lleva a la UGR a tomar la decisión de trasladar la titulación al campus donde actualmente se ubica. Un curso académico más tarde, se comienza a impartir en la Escuela la titulación de Ingeniería de Telecomunicación. En el curso 2011-2012 se empieza a ofrecer el Doble Grado en Ingeniería Informática y Matemáticas, impartido conjuntamente entre la ETSIIT y la Facultad de Ciencias. En el curso actual se ofrece por primera vez el Doble Grado en Ingeniería Informática y Administración y Dirección de Empresas, impartido conjuntamente entre la ETSIIT y la Facultad de Ciencias Económicas y Empresariales.

Actualmente, la Universidad de Granada también imparte la titulación de Ingeniería Informática en su sede en Ceuta.

SEDE URSI 2018

La sede de la URSI 2018 es el **Palacio de Exposiciones y Congresos de Granada**, ubicado en la calle PASEO DEL VIOLÓN, S/N, 18006, GRANADA.



Exterior edificio Palacio de Exposiciones y Congresos de Granada

PROGRAMA

MIÉRCOLES, 05/09/2018						
Desde las 8:00	**Acreditación** Lugar: Zaguán 1ª planta					
9:30-10:30	**Sesión 1.1: Metamateriales y Metasuperficies** Lugar: Sala Andalucía I+II+III	**SESIÓN 1.2: Sesión especial: Canal de propagación (Parte 1)** Lugar: Seminario 1+2	**SESIÓN 1.3: Electromagnetismo** Lugar: Seminario 3+4	**SESIÓN 1.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 1)** Lugar: Seminario 6		
10.30-10:45	**Inauguración** Lugar: Sala Andalucía I+II+III					
10:45-11:30	**Conferencia Plenaria Invitada: Miguel Ángel Lagunas** Lugar: Sala Andalucía I+II+III					
11.30-12:15	**Pausa de Café** Lugar: Zaguán 1ª planta					
12:15-14:00	**SESIÓN 2.1: Antenas (Parte 1)** Lugar: Sala Andalucía I	**SESIÓN 2.2: Sesión especial: Canal de propagación (Parte 2)** Lugar: Seminario 1+2	**SESIÓN 2.3: Sistemas de Comunicación** Lugar: Seminario 3+4	**SESIÓN 2.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 2)** Lugar: Seminario 6	**SESIÓN 2.5: Fotónica y Comunicaciones Ópticas** Lugar: Sala Andalucía II	**SESIÓN 2.6: Sesión especial: Sensores y sistemas inalámbricos** Lugar: Sala Andalucía III
14:00-15:30	**Comida** Lugar: Zaguán 1ª planta					
15:30-17:15	**SESIÓN 3.1: Sesión especial: Técnicas y sistemas de medida de antenas** Lugar: Sala Andalucía I	**SESIÓN 3.2: Aplicaciones Matemáticas: Modelado y Simulación** Lugar: Sala Andalucía II	**SESIÓN 3.3: Sesión especial: Radar** Lugar: Sala Andalucía III	**SESIÓN 3.4: Sesión especial: Comunicaciones por satélite (Parte 1)** Lugar: Seminario 1+2	**SESIÓN 3.5: Sesión especial: Sistemas MIMO** Lugar: Seminario 3+4	**SESIÓN 3.6: Sesión especial: Innovación Educativa en Ingeniería** Lugar: Seminario 6
19:00	**Salida Autobuses** Lugar de salida: Palacio de Congresos (dársena de autobuses de la zona trasera, ver plano del Palacio); destino: Parking Alhambra					
19:45	**Cóctel Bienvenida** Lugar: Carmen de los Mártires (junto a La Alhambra)					
22:00	**Visita Guiada Nocturna a los Palacios Nazaríes de La Alhambra:** Lugar: Organización de grupos guiados en el Carmen de los Mártires					

JUEVES, 06/09/2018						
Desde las 9:00	**Acreditación** Lugar: Zaguán 1ª planta					
9:15-9:45	**Presentación KEYSIGHT** Lugar: Sala Andalucía I+II+III					
9:45-10:15	**Presentación CST** Lugar: Sala Andalucía I+II+III					
10:15-10:45	**Presentación Rohde & Schwarz** Lugar: Sala Andalucía I+II+III					
10:45-11:30	**Conferencia Plenaria Invitada: Rafael Gómez Martín** Lugar: Sala Andalucía I+II+III					
11:30-12:15	**Pausa de Café** Lugar: Zaguán 1ª planta					
12:15-14:00	**SESIÓN 4.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 1)** Lugar: Sala Andalucía I	**SESIÓN 4.2: Comunicaciones Móviles e Inalámbricas (Parte 1)** Lugar: Sala Andalucía II	**SESIÓN 4.3: Sesión especial: Premio URSI2018 a Jóvenes Investigadores** Lugar: Sala Andalucía III	**SESIÓN 4.4: Componentes y Circuitos Activos de Microondas** Lugar: Seminario 1+2	**SESIÓN 4.5: Sesión especial: Ongoing research towards 5G (Parte 1)** Lugar: Seminario 3+4	**SESIÓN 4.6: Sesión especial: Comunicaciones por satélite (Parte 2)** Lugar: Seminario 6
14.00-15:30	**Comida** Lugar: Zaguán 1ª planta					
15:30-17:15	**SESIÓN 5.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 2)** Lugar: Sala Andalucía I	**SESIÓN 5.2: Comunicaciones Móviles e Inalámbricas (Parte 2)** Lugar: Sala Andalucía II	**SESIÓN 5.3: Sesión especial: In memoriam Prof. Dr. Mariano Barba Gea** Lugar: Sala Andalucía III	**SESIÓN 5.4: Sesión especial: Técnicas y tecnologías de fabricación para dispositivos en RF** Lugar: Seminario 1+2	**SESIÓN 5.5: Sesión especial: Ongoing research towards 5G (Parte 2)** Lugar: Seminario 3+4	**SESIÓN 5.6: Sesión especial: Tecnologías en Milimétricas y Terahercios para Comunicaciones y Sensorización** Lugar: Seminario 6
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18:30	**Salida Autobuses** Lugar de salida: Palacio de Congresos (dársena de autobuses de la zona trasera, ver plano del Palacio); destino: Mirador de San Cristóbal					
19:00	**Visita Guiada Albaicín** Lugar comienzo: Mirador de San Cristóbal; Lugar fin: Carmen de los Chapiteles (al pie de La Alhambra, Camino Fuente del Avellano)					
21:00	**Cena de Gala** Lugar: Carmen de los Chapiteles (al pie de La Alhambra, Camino Fuente del Avellano)					

VIERNES, 07/09/2018						
Desde las 9:00	**Acreditación** Lugar: Zaguán 1ª planta					
9:15-10:30	**SESIÓN 6.1:** **Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 1)** Lugar: Sala Andalucía I	**SESIÓN 6.2:** **Componentes y Circuitos Pasivos de Microondas (Parte 1)** Lugar: Sala Andalucía II	**SESIÓN 6.3:** **Sesión especial: Compatibilidad electromagnética** Lugar: Sala Andalucía III	**SESIÓN 6.4:** **Sesión especial: Comunicaciones móviles, planificación y optimización de redes** Lugar: Seminario 1+2	**SESIÓN 6.5:** **Antenas (Parte 2)** Lugar: Seminario 3+4	**SESIÓN 6.6:** **Sesión especial: Bioingeniería y e-health** Lugar: Seminario 6
10:45-11:30	**SESIÓN 7.1:** **Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 2)** Lugar: Sala Andalucía I	**SESIÓN 7.2:** **Componentes y Circuitos Pasivos de Microondas (Parte 2)** Lugar: Sala Andalucía II	**SESIÓN 7.3:** **Sesión especial: Radioastronomía** Lugar: Sala Andalucía III	**SESIÓN 7.4** **WORKSHOP Simulación FDTD en EMC mediante SEMBA** Lugar: Seminario 1+2		
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12:15-13:15	**Conferencia Plenaria Invitada: Eduardo Fernández Jover** Lugar: Sala Andalucía I+II+III					
13:15-13:45	**Clausura y cierre**					
14.00-15:30	**Comida** Lugar: Zaguán 1ª planta					

CONFERENCIAS PLENARIAS

CODIFICACIÓN DE RADIOFRECUENCIA

MIGUEL ÁNGEL LAGUNAS HERNÁNDEZ

Universitat Politècnica de Catalunya

Miércoles, 05/09/2018: **10:45 - 11:30**
Lugar: **Sala Andalucía I+II+III**

Miguel Ángel Lagunas Hernández nació en Madrid (11/10/51). Ingeniero de Telecomunicación UPM (1973), Doctor Ingeniero de Telecomunicación UPC (1976). Becario Fullbrigh Universidad de Colorado en Boulder 82-83. Catedrático UPC Departamento de Teoría de Señal y Comunicaciones (1983-actualidad). IEEE Estudiante/ Senior/Fellow (1973/1978/1997). "Member at large" (1992) Technical Achievement Award (2010) y Fellow de Eurasip. Vicerrector de Investigación UPC (86-89). Vicesecretario General de I+D (CICYT 93-96). Miembro electo de la Real Academia de Ingeniería (1998). Miembro electo de la Real Academia de las Ciencias y las Artes de Barcelona (2007). Académico correspondiente de la Academia de las Ciencias y las Artes de Wesfalia Norte. Su área de actividad se centra en Procesado de Señal y Radiocomunicaciones con contribuciones en análisis espectral, procesado multi-canal, antenas adaptativas, sistemas MIMO y radio cognitiva. Actualmente es director del Centro Tecnológico de Telecomunicaciones de Catalunya CTTC desde diciembre de 2001. (52 publicaciones, 162 conferencias, 31 proyectos de I+D).

RESUMEN

La Codificación de RF es una denominación de toda aquella redundancia, añadida a nivel físico en un sistema de comunicaciones, con el fin primordial de dar viabilidad al diseño e implementación del sistema. Para ancho de banda constante, la codificación de RF reduce la velocidad de información, aunque esa reducción ha de tender a cero cuando la longitud de la trama de datos crece. De este modo, los métodos de secuencia directa proporcionan acceso en radiocomunicaciones, precisión en sistemas de posicionamiento y ganancias de compresión en radar y sonar. En su concepción y uso, puede considerarse como codificación de RF todo tipo de secuencias empleadas para sincronismo y estimación de CSI (Información de Canal). Otros ejemplos son el denominado prefijo cíclico en OFDM o los turbo codificadores, que pueden considerarse, global o parcialmente, como codificación de radiofrecuencia.

La conferencia, en clave de vuelta a procedimientos analógicos en muchos casos, presentará el uso de codificación RF, tanto tipo bloque como convolucional y su papel como referencia para sistemas de conformación de haz y "precoders" para sistemas multi-antena, a la vez que pueden asumir las funciones de acceso, sincronismo y estimación de CSI. Con todo ello, la exposición pretende ser una reivindicación de que los mayores adelantos producidos en los sistemas de comunicación residen y residirán en la capa física de los mismos.

ELECTROMAGNETISMO COMPUTACIONAL EN EL DOMINIO DEL TIEMPO PARA EDUCACIÓN, TECNOLOGÍA ESPACIAL Y OTRAS APLICACIONES

RAFAEL GÓMEZ MARTÍN
Universidad de Granada
Jueves, 06/09/2018: **10:45 - 11:30**
Lugar: **Sala Andalucía I+II+III**

Rafael Gómez Martín obtuvo la Licenciatura en Física por la Universidad de Sevilla en 1971 y en 1974 el Doctorado (Cum Laude) también en Física por la Universidad de Granada, siendo estudiante de doctorado en la Universidad de Santiago de Compostela entre 1971 y 1974. De 1975 a 1985 fue profesor Adjunto en la Universidad de Granada, donde obtuvo la Cátedra en el área de Electromagnetismo en 1986. Forma parte del Departamento de Electromagnetismo y Física de la Materia de la Universidad de Granada donde en 2016 fue nombrado Profesor Emérito. Su interés investigador lo ha enfocado hacia el desarrollo de métodos analíticos y numéricos en Electromagnetismo; antenas, radares de penetración en tierra (GPR), compatibilidad electromagnética, efectos biológicos del Campo Electromagnético, terahertz, y aplicaciones médicas e industriales de las microondas, etc. Es autor de un gran número de artículos publicados en revistas internacionales especializadas en estos temas; así mismo ha participado y dirigido un gran número de proyectos nacionales e internacionales tanto con empresas del sector como con administraciones nacionales y europeas. Ha sido organizador de diversos cursos, seminarios y congresos nacionales e internacionales.

RESUMEN

En esta conferencia se mostrará una pequeña selección de resultados obtenidos a partir de algunos de los proyectos que se han desarrollado o están desarrollándose en mi grupo de investigación y que, a mi juicio, son de interés tanto desde el punto de vista práctico como didáctico. Para ello se usa como nexo de unión la capacidad de visualizar fenómenos electromagnéticos mediante películas (o fotogramas de película) que ofrece el Electromagnetismo computacional en el dominio del tiempo que es el campo donde se ha desarrollado gran parte de nuestra investigación.

La conferencia se dividirá en tres partes:

1) Introducción al Electromagnetismo en el dominio del tiempo.
2) Diseño de antenas de hilo: cómo y por qué radian. Aplicaciones.
3) Estudio de problemas de compatibilidad electromagnética (EMC) en la industria aeronáutica.

En la primera parte, recordaré muy brevemente conceptos básicos que son necesarios para dar fundamento y consistencia a las dos siguientes. En la segunda, trataré de presentar, de forma gráfica, algunos conceptos relacionados con el fenómeno de radiación y sobre por qué y dónde radian las antenas. Finalmente, la tercera parte está enfocada a lo que en gran medida constituye en la actualidad el tema de investigación de nuestro grupo que es proveer a la industria aeronáutica de herramientas numéricas que permitan estudiar la vulnerabilidad de las modernas aeronaves a campos electromagnéticos externos.

EL FUTURO INALÁMBRICO DE LA MEDICINA: APLICACIONES Y RETOS

EDUARDO FERNÁNDEZ JOVER

Universidad Miguel Hernández de Elche

Viernes, 07/09/2018: **12:15 - 13:15**

Lugar: **Sala Andalucía I+II+III**

El Dr. **Eduardo Fernández** es Catedrático de Biología Celular, Director del Grupo de Neuroingeniería Biomédica, Director de la Cátedra de Investigación en Retinosis Pigmentaria Bidons Egara y Subdirector del Departamento de Histología y Anatomía de la Universidad Miguel Hernández de Elche. Realizó sus estudios de Medicina en la Universidad de Alicante (1986) y posteriormente obtuvo su doctorado en Neurociencias (1990). Ha realizado estancias postdoctorales en la

Universidad de Utah (USA), en la Universidad de Oldenburg (Alemania), en el Beth Israel Medical Deaconess Center (Boston, USA) y en la Facultad de Medicina de la Universidad de Viena (Austria). Ha participado en numerosos trabajos y proyectos de investigación relacionados con el estudio del sistema visual y el desarrollo de nuevos dispositivos que puedan ayudar a mejorar la calidad de vida y las capacidades cognitivas y comunicativas de las personas ciegas y/o con diversos problemas neurológicos. El Dr. Eduardo Fernández ha recibido varias distinciones (Premios ONCE I+D; I Premio Fundación Lucha Contra la Ceguera (FUNDALUCE); Premios "Importantes" del Diario Información 2013); I Premio de la Sociedad Española de Farmacia Industrial y Galénica (SEFIG)) por sus trabajos de investigación dirigidos a ayudar a personas ciegas o con problemas visuales. Actualmente se encuentra trabajando en diversos proyectos de I+D+I centrados en patologías neurológicas y neurosensoriales, relacionados fundamentalmente con el desarrollo de nuevos dispositivos y sistemas capaces de interactuar de manera bidireccional (registro y estimulación) con el sistema nervioso, con el desarrollo de nuevas aproximaciones terapéuticas para el tratamiento de las enfermedades neurodegenerativas y con nuevas tecnologías de neurorrehabilitación.

RESUMEN

Durante los últimos años se han producido un gran número de avances en diversos campos científicos relacionados con la biomedicina, la ingeniería y la electrónica que están permitiendo desarrollar nuevas tecnologías e instrumentos para proteger y mejorar la salud. Por ejemplo, hoy en día se pueden realizar registros cardiacos o incluso monitorizar la función cerebral en personas durante sus actividades diarias y enviar toda esta información, en tiempo real, a diversos dispositivos móviles y/o fijos. Además, existen ya dispositivos electrónicos que permiten restituir la audición en algunos pacientes sordos, proporcionar una cierta percepción del entorno en sujetos ciegos o recuperar algunas funciones motoras en pacientes tetrapléjicos. Los principios biológicos básicos en los que se basan estos dispositivos son conocidos desde hace más de 150 años, por lo que nos podríamos preguntar: ¿por qué se ha tardado tanto tiempo en desarrollar estos dispositivos?, ¿cuáles son sus principales aplicaciones y los retos actuales? El futuro es esperanzador pero implica la formación de equipos de investigación multidisciplinares que sean capaces de afrontar con garantías de éxito todos estos retos. Además, es necesario avanzar poco a poco y no crear falsas esperanzas que podrían afectar de forma negativa a la credibilidad de estas tecnologías.

In memoriam Prof. Dr. Mariano Barba Gea

Sesión especial, JUEVES 06/09/2018, 15:30-17:15
Lugar: **Sala Andalucía III**

Mariano Barba nacido en Murcia el 15 de Enero de 1967, obtuvo el título de Ingeniero de Telecomunicación en 1990 y el título de Doctor Ingeniero de Telecomunicación en 1996 ("Apto cum laude"), ambos por la Universidad Politécnica de Madrid.

En 1991 inició su actividad investigadora en el Departamento de Electromagnetismo y Teoría de Circuitos, contribuyendo al desarrollo de métodos numéricos para el diseño y caracterización de dispositivos pasivos de microondas.

Desde 1994 hasta 2002, Mariano desarrolló una intensa actividad de I+D en antenas y componentes RF para comunicaciones, tanto terrestres como espaciales, en empresas y centros de investigación (INTA, Alcatel Espacio, RYMSA y Airspan-Reino Unido).

Mariano siempre mostró una gran pasión por la enseñanza, iniciando su actividad docente en la Universidad Europea de Madrid (1996-1999) e incorporándose en 2003 como Profesor Titular al Departamento de Electromagnetismo y Teoría de Circuitos (actualmente integrado en el Dpto. de Señales, Sistemas y Radiocomunicaciones) de la UPM. Mariano impartió con gran ilusión y dedicación diferentes asignaturas y laboratorios de grado y master. Dirigió un gran número de Proyectos Fin de Carrera y Trabajos Fin de Grado, mostrando siempre un gran entusiasmo en llegar hasta las etapas de construcción y medida de los prototipos diseñados.

En cuanto a su actividad investigadora, Mariano dirigió y participó en numerosos proyectos de investigación nacionales (Planes Nacionales, Comunidad de Madrid), e internacionales (ESA, FP6, FP7) y mantuvo una estrecha colaboración en I+D+I con empresas líderes en comunicaciones y tecnología espacial (Thales Alenia Space, Airbus, Tryo, Huawei). Mariano realizó contribuciones significativas en el desarrollo de antenas de haz reconfigurable y barrido electrónico, empleando tecnologías novedosas (MEMS, Cristales Líquidos). Estas líneas de investigación han dado lugar a numerosas publicaciones científicas y patentes. La proyección internacional de Mariano Barba ha permitido consolidar colaboraciones con Instituciones de reconocido prestigio internacional (Universidad de Perugia, Univ. de Toronto, Politécnico de Montreal, Queen's University Belfast, Foundation Bruno Kessler - Irst).

Mariano fue un gran impulsor del laboratorio de investigación y prototipado del Grupo de Electromagnetismo y Teoría de Circuitos de la Universidad Politécnica de Madrid. Por ello, y para honrar su memoria, dicho laboratorio lleva actualmente el nombre de Mariano Barba.

La actitud proactiva de Mariano, su ilusión por la validación experimental y su predisposición a afrontar nuevos retos y a ayudar a los demás, hacen que Mariano deje una huella imborrable.

Mariano falleció el 20 de julio de 2017, pero siempre estará en la memoria de quienes convivieron con él como profesor, como investigador e ingeniero, pero sobretodo como compañero y amigo.

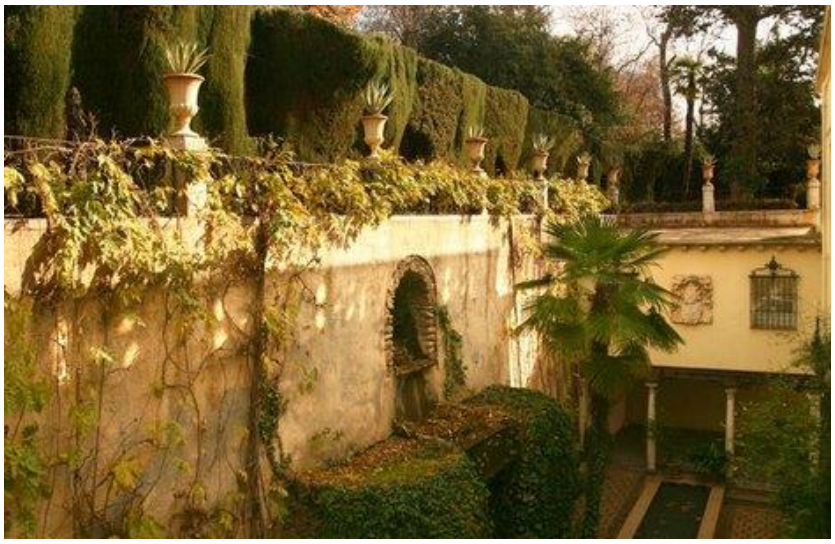
PROGRAMA SOCIAL

CÓCTEL DE BIENVENIDA

Miércoles, 05/09/2018: **19:45h**
Lugar: Carmen de los Mártires, Paseo de los Mártires s/n (Autobuses desde Palacio de Congresos)

El **Carmen de los Mártires** es una construcción que data del s. XIX en la ciudad de Granada. Compuesta de palacete y amplios jardines: un jardín barroco francés, con un amplio estanque en cuyo centro hay una estatua de Neptuno y rodeado por otras estatuas que representan las cuatro estaciones; un jardín "a la inglesa", el Jardín de las Palmeras, con una fuente de tres pisos y cuadros irregulares de setos rectos y con palmeras; el Jardín Español, eliminado en 1960; el Jardín Paisajista, el Lago, con un estanque de riego que la vegetación trata de disimular, llegando a percibirse como lago, rodeado de dos isletas para patos y cisnes, la más pequeña, y ajardinada con setos y con un embarcadero de piedra con una falsa ruina medieval, la mayor; el Patio Nazarí, de 1944, en el que se copian miméticamente los elementos típicos de la jardinería nazarí, el Bosque-Laberinto que servía para enlazar los jardines.

El desplazamiento al Carmen de los Mártires se realizará mediante autobús, cuya salida está programada a las 19:00h desde la parte trasera del Palacio de Congresos. El autobús finalizará su recorrido en el parking del acceso nuevo de La Alhambra, desde donde se accederá al edificio del Carmen de los Mártires a través de un hermoso paseo.



Jardines y patios Carmen de los Mártires

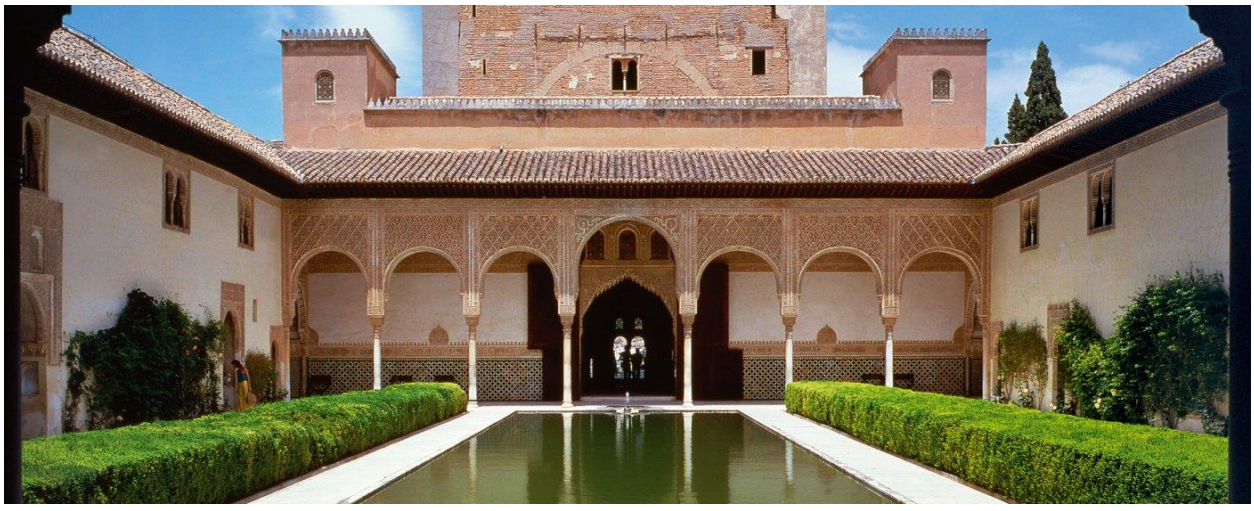
VISITA GUIADA NOCTURNA A LOS PALACIOS NAZARÍES DE LA ALHAMBRA

Miércoles, 05/09/2018: aprox. **22:00h**
Lugar: Palacios Nazaríes

Los **Palacios Nazaríes** son un conjunto palacial, residencia de los reyes de Granada. Lo empieza a construir el fundador de la dinastía nazarí, Alhamar, en el s. XIII, aunque las edificaciones que han pervivido hasta nuestros días datan, principalmente, del s. XIV. Tres palacios forman este recinto:

- El Mexuar es la sala más antigua. Usada para reuniones de los ministros del rey así como lugar donde se impartía justicia.
- El Palacio de Comares. Su construcción data de la época de Yusuf, está compuesto por una serie de dependencias alrededor del Patio de los Arrayanes, destacándose las salas de los Embajadores y la de la Barca.
- El Palacio de los Leones, de la época de Mohamed V, está compuesto por un patio central, el Patio de los Leones, y en cada lateral una sala, la de los Mocárabes, los Reyes, Dos Hermanas, Ajimeces, mirador de Daraxa, los Abencerrajes y el Harén.

Para realizar la visita se organizarán grupos guiados que iniciarán el recorrido desde el Carmen de los Mártires, donde se celebra el cóctel de bienvenida.



Patio de los Arrayanes

VISITA GUIADA AL ALBAICÍN

Jueves, 06/09/2018: **19:00h**
Lugar: Plaza Mirador de San Cristóbal (Autobuses desde Palacio de Congresos)

El **Albaicín** es una de las señas mayúsculas de la identidad granadina. El barrio está recostado sobre una altiva loma frente a la colina roja de La Alhambra. Sus calles son sinuosas, estrechas y huidizas; sus plazas, luminosas, recogidas e íntimas; los palacios, casonas e iglesias rebosan de historia y arte.

En el Albaicín abundan los cármenes, que son casas con jardín, típicamente granadinas y los torreones mudéjares. Los miradores de San Nicolás y San Cristóbal ofrecen magníficas vistas de Granada y La Alhambra. Aún se conservan restos de mezquitas, alminares, aljibes hispano-musulmanes y sobre todo un regusto muy andalusí y un sabor a vida cotidiana, bulliciosa y alegre. Las plazas de Porras, del Cristo de las Azucenas y de San Miguel Bajo transportan al visitante a través de la nostalgia de una época, ya muy lejana en el tiempo.

La visita comenzará en el Mirador de San Cristóbal. **El desplazamiento hasta este lugar se realizará mediante autobús, cuya salida está programada a las 18:30h desde la zona trasera del Palacio de Congresos**. La visita finalizará en Carmen de los Chapiteles (al pie de La Alhambra, Cuesta de los Chinos), donde a continuación se celebrará la cena de gala.

Vistas desde el Mirador de San Nicolás

CENA DE GALA

Jueves, 06/09/2018: aprox. **21:00h**
Lugar: Carmen de los Chapiteles, Camino Fuente del Avellano, 4

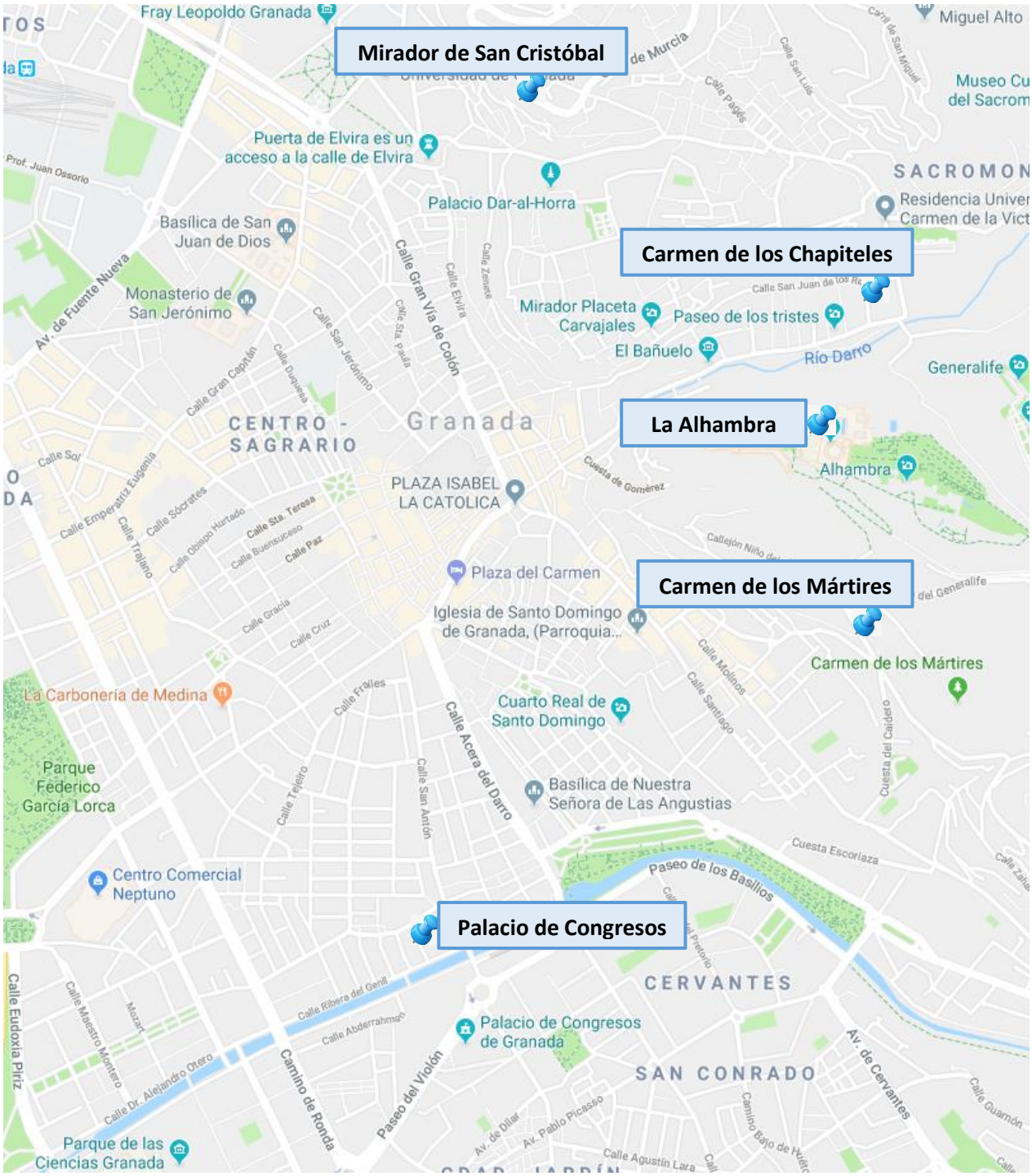
El **Carmen de los Chapiteles** está ubicado en un entorno único al amparo de los jardines del Generalife en La Alhambra y frente a los carismáticos y populares barrios del Albaicín y El Sacromonte. Sus orígenes se remontan al siglo XIV y, seis siglos después, aún se pueden admirar sus artesonados originales y disfrutar de la belleza de sus jardines nazaríes.

El Carmen fue un regalo de los Reyes Católicos al General que mandaba sus ejércitos, el Gran Capitán, D. Gonzalo Fernández de Córdoba, cuando se tomó la ciudad de Granada y se puso fin a la Reconquista. De esta forma, empezó la historia de la que ya en su día era una de las casas más hermosas y preciadas de la ciudad. En su interior, se encuentran varias reliquias perfectamente conservadas, bellos salones ideales y unos espectaculares jardines con una panorámica única de Granada.

La llegada al lugar será el punto final de la visita guiada por el Albaicín.

Vista nocturna del Carmen de los Chapiteles

PUNTOS DE INTERÉS



Mapa Google del centro de Granada

ÍNDICE DE SESIONES

SESIÓN 1.1: Metamateriales y Metasuperficies

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **Óscar Quevedo Teruel y Gregorio José Molina Cuberos**
Lugar: Sala Andalucía I+II+III

9:30h S1.1.1 Caracterización de la frecuencia de resonancia de un metamaterial quiral formado por manivelas de cinco segmentos
J. M. Cuadrado Ochotorena, G. J. Molina-Cuberos, A. J. García-Collado, J. Margineda

9:45h S1.1.2 Design Methodology of Dual-Band Single-Layer Leaky Wave Antennas
Nausika Memeletzoglou, Darwin Blanco Montero, Eva Rajo-Iglesias

10:00h S1.1.3 Estructuras electromagnéticas con simetrías helicoidales
O. Quevedo-Teruel, O. Dahlberg, Q. Chen, F. Ghasemifard

10:15h S1.1.4 Implementación de antena leaky-wave basada en metasuperficie de Huygens
Elena Abdo-Sánchez, Ariel Epstein, George V. Eleftheriades

SESIÓN 1.2: Sesión especial: Canal de propagación (Parte 1)

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **José Manuel Riera Salís y Luis Mendo Tomás**
Lugar: Seminario 1+2

9:30h S1.2.1 Caracterización del canal radio en el interior de un metro a 26, 28, 33 y 38 GHz
Lorenzo Rubio, Vicent M. Rodrigo-Peñarrocha, Juan Reig, Juan Pascual-García, José-María Molina-García-Pardo y Leandro Juan-Llacer

9:45h S1.2.2 Análisis de la aplicabilidad de las técnicas de trazado de rayos para analizar canales V2V en entornos complejos.
Rafael P. Torres, Jesús R. Pérez, Luis Valle, J. Basterrechea, Marta Domingo, Jorge González, Herman Fernández, Lorenzo Rubio, Vicent M. Rodrigo-Peñarrocha, Juan Reig

10:00h S1.2.3 Fundamentos y Aplicaciones del Modelo de Fading κ-μ Shadowed
J. F. París

10:15h S1.2.4 Clasificación de eventos de lluvia y evaluación de sus efectos sobre la propagación a partir de perfiles radar en banda K
Santiago Pérez Peña, Marta Munilla Díez, José Manuel Riera, Ana Benarroch

SESIÓN 1.3: Electromagnetismo

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **José Mª Gil y Alejandro Javier Martínez Ros**
Lugar: Seminario 3+4

9:30h S1.3.1 A general procedure for a frequency-stable singularity cancellation in local space for Integral Equations
Fernando Conde-Pumpido, José Mª Gil

9:45h S1.3.2 RCS and Reflectivity Good Agreement in Measured and Simulated Rain
Guillermo D. Rodríguez, R. Ezequiel García, Juan P. Ciafardini, J. Alberto Bava, Miguel Ferrando Bataller

10:00h S1.3.3 Diseño de un filtro balanceado con doble banda de paso basado en resonadores SIR complejos acoplados magnéticamente
Armando Fernández-Prieto, Pedro Ugarte, Jesús Martel, Aintzane Lujambio, Alejandro Martínez-Ros, Francisco Medina, Rafael R. Boix y Ferrán Martín

10:15h S1.3.4 Estudio sobre la Convergencia en la Red Multimodal Equivalente para el Análisis de Dispositivos en Guía de Onda
Celia Gómez Molina, Fernando Quesada Pereira, Alejandro Álvarez Melcón, Vicente Boria Esbert, Marco Guglielmi

SESIÓN 1.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 1)

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **Ángel San Blas Oltra y Ángela Coves Soler**
Lugar: Seminario 6

9:30h S1.4.1 Análisis, diseño e implementación de un nuevo filtro SIW basado en secciones dieléctricas alternas
Juan R. Sánchez, Carmen Bachiller, María Julia, Vicente Nova, Héctor Esteban y Vicente E. Boria

9:45h S1.4.2 Síntesis y diseño de filtros paso-bajo reconfigurables en SIW para aplicaciones espaciales
Clara Máximo Gutiérrez, Alejandro Álvarez Melcón, Juan Hinojosa Jiménez

10:00h S1.4.3 Diseño de filtros paso banda en tecnología guía de onda mediante fabricación aditiva
José María García Barceló, Alejandro Pons Abenza, Alejandro Álvarez Melcón, Fernando D. Quesada Pereira, Juan Hinojosa Jiménez

10:15h S1.4.4 Diseño práctico de un filtro paso-banda empleando una estructura SIW periódica
David López Navarro, Ángela Coves Soler, Enrique Bronchalo Bronchalo, German Torregrosa Peñalva y Maurizio Bozzi

SESIÓN 2.1: Antenas (Parte 1)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Adrián Tamayo Domínguez y José Manuel Fernández González**
Lugar: Sala Andalucía I

12:15h S2.1.1 Nuevo enfoque para el diseño de UWB Antenas con radiación de directivas para aplicaciones BAN
Hamza Benchakroun, Marta Cabedo-Fabrés, Adnane Latif, Miguel Ferrando-Bataller

12:30h S2.1.2 Design of Broadband Antenna for New Mobile Communication Base Stations
Sergio Martín-Antón, Daniel Segovia-Vargas

12:45h S2.1.3 Bocina activa plano-H en tecnología SIW
Nuria Esparza, L.F. Herrán

13:00h S2.1.4 A Planar Array Slot Antenna Fed by Top-to-Bottom-Contactless Waveguides
A. T. Muriel-Barrado, M. Sierra-Pérez, J. M. Fernández-González

13:15h S2.1.5 Antena Dual (K/Ka) de bajo perfil utilizando tecnología de guía Gap
Miguel Ferrando-Rocher, Alejandro Valero-Nogueira, Daniel Sánchez-Escuderos, José I. Herranz-Herruzo

13:30h S2.1.6 Elemento Radiante de Banda Ancha en Microstrip Cerrada para Arrays Alimentados en Serie
Alberto Hernández Escobar, Elena Abdo Sánchez, Carlos Camacho Peñalosa

SESIÓN 2.2: Sesión especial: Canal de propagación (Parte 2)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **José Manuel Riera Salís y Luis Mendo Tomás**
Lugar: Seminario 1+2

12:15h S2.2.1 Medidas de atenuación en entorno de interiores para ondas milimétricas: montaje experimental y primeros resultados
Pedro José Sáiz Coronado, Domingo Pimienta-del-Valle, Luis Mendo Tomás, Pedro García-del-Pino, José Manuel Riera

12:30h S2.2.2 Scattering Model of Wind Turbines in the Frequency Bands of Weather Radars

David de la Vega, Itziar Angulo, David Guerra, Pablo Angueira, Juan Luis Ordiales

12:45h S2.2.3 Simulación del canal inalámbrico utilizando modelos geométricos extraídos a partir de nubes de puntos

Juan Pascual-García, José-María Molina-García-Pardo, María-Teresa Martínez-Inglés, José-Víctor Rodríguez, Leandro Juan-Llácer

13:00h S2.2.4 UWB Propagation for Medical In-Body Devices

Concepción García-Pardo, Carlos Andreu Estellés, Sofía Pérez Simbor, Sergio Castelló Palacios, Alejandro Fornes-Leal, Martina Barbi, Ana Vallés-Lluch, Narcis Cardona

13:15h S2.2.5 Wireless Channel Characterization of Context Aware Environments and Applications

Leyre Azpilicueta, Fran Casino, Peio Lopez-Iturri, Erik Aguirre, Mikel Celaya-Echarri, Agusti Solanas, Francisco Falcone

13:30h S2.2.6 Experimento con Alphasat en Madrid: Resultados y modelado de la probabilidad de ocurrencia de los desvanecimientos.

Domingo Pimienta del Valle, José M. Riera, Pedro García-del-Pino, Gustavo A. Siles

SESIÓN 2.3: Sistemas de Comunicación

Presidentes de sesión: **Juan Valenzuela Valdés y Javier Carmona Murillo**
MIÉRCOLES, 12:15-14:00
Lugar: Seminario 3+4

12:15h S2.3.1: Análisis comparativo de las tecnologías de capa física propuestas en el estándar IEEE P1901-2010

Fausto García G., Freddy A. Pinto Benel y Fernando Cruz Roldan

12:30h S2.3.2 Análisis del canal de comunicación inalámbrico y su impacto en los mecanismos de gestión de la movilidad

Javier Carmona Murillo, Juan Francisco Valenzuela Valdés, Pablo Padilla, Juan Carlos González Macías, Francisco Javier Rodríguez Pérez, Francisco Luna Valero

12:45h S2.3.3 Erasable/Programmable Chipless-RFID Tags with Orientation-Independent Sequential Bit Reading

Cristian Herrojo, Miquel Moras, Ferrán Paredes, Javier Mata-Contreras, Alba Núñez, Eloi Ramon,Ferrán Martín

13:00h S2.3.4 Estudio de la influencia de la correlación y el desbalanceo de potencia en Sistemas MIMO Distribuidos.

J.C. Gonzalez-Macías, Antonio Valenzuela-Valdés, J.F Valenzuela-Valdés, Javier Carmona Murillo, P. Padilla

13:15h S2.3.5 Optimización del rango de operación en aplicaciones de Interferometría RF
Jesús Benítez y José Mora

13:30h S2.3.6 Desfasador electrónicamente reconfigurable en banda Ku optimizado con algoritmos genéticos
Mohamed Taha ElKhorassani, Miguel Ángel Vaquero, Ángel Palomares, Juan F. Valenzuela-Valdés, Pablo Padilla y Naima Amar Touhami

SESIÓN 2.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 2)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Ángel San Blas Oltra y Ángela Coves Soler**
Lugar: Seminario 6

12:15h S2.4.1 Diseño sistemático de filtros comb-line en línea implementados en tecnología guiada.
Ángel A. San Blas, P. González, Vicente E. Boria, Pablo Soto, Marco Guglielmi

12:30h S2.4.2 Estudio de Distintas Técnicas de Ajuste de Campo para Analizar Dispositivos en Guía de Onda de Comunicaciones por Satélite.
Juan Córcoles Ortega, Raúl V. Haro Baez, José R. Montejo Garai, Ana Morán López, Lucas Polo López, Jesús M. Rebollar, Jorge A. Ruiz Cruz

12:45h S2.4.3 Filtro Pasobanda con Alto Factor de Calidad en Línea Coaxial Integrada en Sustrato Vacío (ESICL) para Aplicaciones Espaciales.
Leticia Martínez, Alejandro L. Borja, Héctor Esteban, Vicente E. Boria, Ángel Belenguer

13:00h S2.4.4 Receptor criogénico en banda Ka para aplicaciones de espacio profundo.
Ángel Mediavilla, Juan L. Cano, David Vegas, Eduardo Artal, Antonio Tazón, Luisa M. de la Fuente, Cédric Chambon, Benoit Faroux, Remi Rayet, Steve Rawson, Stephane Halté

13:15h S2.4.5 Técnica de diseño de corrección en frecuencia para filtros de cavidades arbitrarias 3D.
Alejandro Pons Abenza, Alejandro Álvarez Melcón, Fernando Quesada Pereira, Lara Arche Andradas

13:30h S2.4.6 Validación de la Tecnología Empty Substrate Integrated Waveguide en Banda Q.
Juan A. Martínez, Ángel Belenguer, Héctor Esteban y Vicente E. Boria

SESIÓN 2.5: Fotónica y Comunicaciones Ópticas

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Pedro Chamorro Posada y Miguel del Castillo Vázquez**
Lugar: Sala Andalucía II

12:15h S2.5.1 Amplificador óptico de fibra dopada con Er/Yb y múltiples cubiertas para redes ópticas de distribución de CATV

Borja Fernández, Álvaro Albero, Beatriz Ortega, Rafael de Uña

12:30h S2.5.2 Análisis de la probabilidad de error en sistemas de comunicaciones ópticas subacuáticas afectadas por turbulencia inducida por salinidad

Nuria González Serrato, Antonio Jurado-Navas, José María Garrido-Balsells, Miguel del Castillo-Vázquez, Antonio Puerta-Notario

12:45h S2.5.3 Comparación de las técnicas OFDM y multi-CAP para comunicaciones ópticas MIMO en el visible

Oswaldo González, Khald Werfli, Navid B. Hassan, Andrew Burton, Zabih Ghassemlooy, Hoa Le Minh

13:00h S2.5.4 Wavelength demultiplexor inscribed in optical fiber end-face by femtosecond laser

D. Pallarés-Aldeiturriaga, L. Rodríguez-Cobo, M. Lomer and J.M. López-Higuera

13:15h S2.5.5 Dispositivos basados en guías curvas acopladas asimétricas para integración fotónica en nitruro de silicio

Pedro Chamorro-Posada

13:30h S2.5.6 Parametrización física de canales ópticos turbulentos modelados con la distribución M

José M. Garrido Balsells, Antonio Puerta Notario, Antonio Jurado Navas, Miguel del Castillo Vázquez

13:45h S2.5.7 Simulador de dispositivos SLM basados en cristal líquido

Nicolás J. Gallego Molina, Antonio Puerta Notario, Miguel del Castillo Vázquez, José M. Garrido Balsells

SESIÓN 2.6: Sesión especial: Sensores y sistemas inalámbricos

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Sandra Sendra Compte y Lorena Parra Boronat**
Lugar: Sala Andalucía III

12:15h S2.6.1 Comparativa de técnicas de estimación de la velocidad puntual de vehículos usando sensores inductivos de doble bucle.

José J. Lamas-Seco, Paula M. Castro, Francisco J. Vázquez-Araujo, Francisco Laport, Adriana Dapena

12:30h S2.6.2 Impact of Clock Frequency on the Performance and Consumption of a Secure IoT Node

Manuel Suárez-Albela, Tiago M. Fernández-Caramés, Paula Fraga-Lamas, Luis Castedo

12:45h S2.6.3 Performance of LoRaWAN on a Highway Scenario

Pablo Romero Díaz, Jorge Navarro Ortiz, Sandra Sendra, Juan J. Ramos Muñoz

13:00h S2.6.4 An IoT System for Monitoring Indoor Radon Gas Exposure.
Óscar Blanco-Novoa, Tiago M. Fernández-Caramés, Paula Fraga-Lamas, Luis Castedo

13:15h S2.6.5 Fosforímetro modular de bajo coste para la determinación *in situ* de oxígeno gaseoso.
Santiago Medina Rodríguez, Carlos Medina Rodríguez, Ángel de la Torre Vega, José C. Segura Luna, Jorge F. Fernández Sánchez

13:30h S2.6.6 Smart Irrigation Tube: a Wireless System for Water Detection in Precision Agriculture.
Lorena Parra, Javier Rocher, Sandra Sendra, Jaime Lloret

SESIÓN 3.1: Sesión especial: Técnicas y sistemas de medida de antenas

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Fernando Las Heras Andrés y Manuel Sierra Castañer**
Lugar: Andalucía I

15:30h S3.1.1 Advances in Reverberation Chamber antenna testing
Miguel Á. García-Fernández, David A. Sánchez-Hernández

15:45h S3.1.2 In-situ Antenna Diagnostics and Characterization by means of Unmanned Aerial Vehicles
Yuri Álvarez López, María García Fernández, Ana Arboleya Arboleya, Borja González Valdés, Yolanda Rodríguez Vaqueiro, Fernando Las-Heras Andrés

16:00h S3.1.3 Iterative Method for Near Field to Far Field Transformation over Arbitrary Measurement Surfaces
Fernando Rodríguez Varela, Manuel Sierra Castañer, Belén Galocha Iragüen

16:15h S3.1.4 Evaluation of Software Defined Radio Receiver for Phaseless Near-Field Measurements
Rubén T. Sánchez, Manuel Sierra Castañer, L.J. Foged

16:30h S3.1.5 INTA facilities and methods for electromagnetic characterization of aerospace composite materials
Borja Plaza Gallardo, Patricia Gómez de Francisco, David Escot Bocanegra, David Poyatos Martínez

SESIÓN 3.2: Aplicaciones Matemáticas: Modelado y Simulación

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Juan Córcoles Ortega y Miguel Ferrando Bataller**
Lugar: Sala Andalucía II

15:30h **S3.2.1 Red Transversa Equivalente de una LWA en Tecnología SIW Funcionando con el Modo TE20.**
Alejandro Javier Martínez-Ros, Fernando Quesada-Pereira y Francisco Medina

15:45h **S3.2.2 Three-level parallelization of a Finite Element Code with Hybrid Meshes.**
Adrián Amor-Martín, Daniel García-Donoro and Luis Emilio García-Castillo

16:00h **S3.2.3 Método de extracción directa de modelos comportamentales a partir de medidas NVNA**
M. Rocío Moure, Michael Casbon, Mónica Fernández Barciela, Paul J. Tasker

16:15h **S3.2.4 Solving Extremely Large Periodic Structures Through Slot FFT Techniques.**
A. Serna, L. Landesa, M. F. Manzano, J. M. Taboada

16:30h **S3.2.5 Análisis en frecuencia de lente de Fresnel en microondas mediante simulación full-wave**
Patricio Gross, Julieta Vernieri, Felipe Vico, José Alberto Bava, Miguel Ferrando Bataller

16:45h **S3.2.6 Análisis Estadístico de Formas Cuadráticas Gaussianas Complejas No Centrales**
Pablo Ramírez Espinosa, José F. Paris, José A. Cortés, Eduardo Martos Naya

17:00h **S3.2.7 Caracterización de modelos no-lineales casi-estáticos a partir de las formas de onda en régimen de gran señal**
Sergio Pérez Parras, Teresa M. Martín Guerrero, Janie D. Baños Polglase, Carlos Camacho Peñalosa

SESIÓN 3.3: Sesión especial: Radar

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Mateo Burgos García y Guillermo Posada Quijano**
Lugar: Sala Andalucía III

15:30h **S3.3.1 Desarrollo de Algoritmos de altas Prestaciones para la Calibración de Retardos en Phased Arrays Digitales**
Marta Castiella Fernández, Mateo Burgos García, Carlos F. Castillo Rubio

15:45h **S3.3.2 Evaluation of Different Techniques for Sidelobes Reduction in Phase Coded Radar Signals**
Lourdes Muñoz Miguel, Mu Shen, Rodrigo Blázquez García, Mateo Burgos García

16:00h **S3.3.3 On the use of LTE-R signals for passive multistatic radar systems**
Rodrigo Blázquez-García, Jorge Casamayón-Antón, Mateo Burgos-García

16:15h **S3.3.4 Drone Detection and RCS Measurements with X-Band Ubiquitous Radar**
Álvaro Duque de Quevedo, Fernando Ibáñez Urzaiz, Javier Gismero Menoyo, Alberto Asensio López

16:30h **S3.3.5 Oscilador Digital Sintonizable de 6 a 20 GHz con Estabilización en Temperatura Ultra-Rápida y Modulación en Frecuencia de Banda Ancha**
Javier Montero-de-Paz, Jesús López-Paniego, Juan José Sánchez-Martínez, Antonio Bódalo Márquez

16:45h **S3.3.6 Estudio de Honeycomb Dieléctrico como Substrato de Microondas para Antenas de Radares 3D de Largo Alcance**
G. Posada, J.I. Gómez, C. Zarzuelo

SESIÓN 3.4: Sesión especial: Comunicaciones por satélite (Parte 1)

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Miguel Calvo Ramón y Miguel A. Salas Natera**
Lugar: Seminario 1+2

15:30h **S3.4.1 HAPs as a disruptive solution for sky communications and their interaction with current and future SATCOM systems**
Antonio Abad, Pedro Pintó Marín

16:00h **S3.4.2 Design of Gateway diversity systems for Very High Throughput Satellites (VHTS)**
Michel Massanet Ginard, Ramón Martínez Rodríguez-Osorio

16:15h **S3.4.3 Modelo de análisis de interferencia producida por skew angle en array planos para comunicaciones por satélite**
Borja Rocha Peñalosa, Miguel A. Salas-Natera, Flor Ortiz, Ramón Martínez, José Luis Ruiz Dou, Carlos Zarzuelo Torres

SESIÓN 3.5: Sesión especial: Sistemas MIMO

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Matilde Sánchez Fernández y Juan José Murillo Fuentes**
Lugar: Seminario 3+4

15:30h **S3.5.1 Antenas para estaciones base 5G definidas por software**
Aníbal Llanga-Vargas, Carlos Ramiro Peñafiel-Ojeda, Daniel Santillán-Haro, Marta Cabedo-Fabrés, Eva Antonino-Daviu, Miguel Ferrando-Bataller

15:45h **S3.5.2 A precoding + PAPR reduction scheme for Multi User MIMO-OFDM downlink**
Álvaro Sanz García-Sintas, Francisco Javier González Serrano

16:00h **S3.5.3 Performance comparison between analog JSCC and digital schemes over MIMO channels**
O. Fresnedo, F. J. Vázquez-Araújo, P. Suárez-Casal, L. Castedo

16:15h **S3.5.4 Imperfect CSI at the Expectation Consistency MIMO detector**
Javier Céspedes, Pablo M. Olmos

16:30h S3.5.5 Improved probabilistic EP-based receiver for MIMO systems and high-order modulations
Irene Santos, Juan José Murillo-Fuentes

16:45h S3.5.6 Phase Noise Effects in Zero-Forcing Multi-User Massive MIMO Uplink and Downlink
Alberto Álvarez Polegre, Ana García Armada, Roberto Corvaja

17:00h S3.5.7 Inversión Aproximada de Matrices en Sistemas Massive MIMO Correlados en Tiempo o Frecuencia
Óscar Cobos Morales, Rafael Soldado Guerrero, Eduardo Martos Naya, Francisco Javier López Martínez, José Tomás Entrambasaguas Muñoz

SESIÓN 3.6: Sesión especial: Innovación Educativa en Ingeniería

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Alejandro Ayala Alfonso y Oswaldo B. González Hernández**
Lugar: Seminario 6

15:30h S3.6.1 Desafío Tecnológico: Herramienta para trabajar y evaluar las competencias básicas y generales en los estudios de grado de la E.T.S.I. de Telecomunicación
Ana M. Barbancho, Isabel Barbancho, Lorenzo J. Tardón, Alberto Peinado, Jorge Munilla, Andrés Ortiz, F. Javier Mata

15:45h S3.6.2 Desarrollo de actividades prácticas dirigidas a la adquisición de competencias profesionales
Pedro J. Reyes-Iglesias, José María Garrido-Balsells

16:00h S3.6.3 Enseñar a innovar a ingenieros
Miguel Laso, Iván Arregui y David Benito

16:15h S3.6.4 Experiencias de laboratorio para el estudio de señales de AM y FM
Alejandro José Ayala Alfonso, Silvestre Rodríguez Pérez, Beatriz Rodríguez Mendoza y Oswaldo González Hernández

16:30h S3.6.5 Hands-on Electronics Laboratory in Fully Online Engineering Education
Carlos Monzo, Germán Cobo, David García-Solórzano, José Antonio Morán, Eugènia Santamaría

16:45h S3.6.6 Laboratorio de Radar Monopulso en Amplitud usando tarjetas WiFi
Miguel Poveda-García, María Pérez-Buitrago, Antonio Gómez-Alcaraz, Luis Miguel Martínez-Tamargo, Alejandro Martínez-Sala, David Cañete-Rebenaque, José Luis Gómez Tornero

17:00h **S3.6.7 Tecnología de comunicaciones móviles al alcance de todos: la experiencia del MOOC**

Raquel Pérez Leal, José Joaquín Escudero Garzas, Borja Genovés Guzmán, Víctor P. Gil Jiménez, Ana García Armada

SESIÓN 4.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Salvador González García y Mario Fernández Pantoja**
Lugar: Sala Andalucía I

12:15h **S4.1.1 Aceleración de Problemas Electromagnéticos Multiescala mediante el Método de Descomposición de Dominios**

Victor F. Martin, David Larios, José M. Taboada, Luis Landesa, F. Obelleiro, Diego M. Solis

12:30h **S4.1.2 Aplicaciones de la simulación electromagnética en sistemas anticolisión en vehículos**

Lorena Lozano, Álvaro Somolinos, Iván González, Felipe Cátedra

12:45h **S4.1.3 El Método de Elementos Finitos con Segmentación Modal (FEM-MS) aplicado al diseño de antenas**

Rafael Gómez Alcalá, Jesús Rubio, Miguel A. González de Aza, Jesús García, José M. Gil, Pedro Robustillo, Juan Zapata

13:00h **S4.1.4 Estudio Numérico y Experimental de las Resonancias de Schumann**

Jesús Fco. Fornieles Callejón, Alfonso Salinas Extremera, Jesús Rodríguez Camacho

13:15h **S4.1.5 GRECO: 30 years of graphical processing techniques for RCS computation**

Juan M. Rius, Eduard Úbeda, Alexander Heldring

13:30h **S4.1.6 Iones y electrones en la baja atmósfera de Titán**

Gregorio J. Molina-Cuberos, Ángel J. García-Collado, José J. López-Moreno, José Margineda, Sergio Toledo-Redondo

SESIÓN 4.2: Comunicaciones Móviles e Inalámbricas (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Francisco Falcone Lanas y Ana M. Torres Aranda**
Lugar: Sala Andalucía II

12:15h **S4.2.1 Comparativa de técnicas de estimación de canal para VLC en interiores**

Juan Carlos Estrada-Jiménez, Borja Genovés Guzmán, M. Julia Fernández-Getino García, Víctor P. Gil Jiménez

12:30h S4.2.2 Layered ACO-CP-OFDM with insufficient Cyclic Prefix for Visible Light Communications
Kun Chen-Hu, Borja Genovés Guzmán, Víctor P. Gil Jiménez and Ana García Armada

12:45h S4.2.3 Vulnerabilidades en Vehículos Aéreos no Tripulados de Uso Comercial
Sandra Pérez Arteaga, Luis Alberto Martínez Hernández, Linda Karina Toscano Medina, Gabriel Sánchez Pérez, Luis Javier García Villaba

13:00h S4.2.4 Estudio de emisiones radioeléctricas de redes GSM y UMTS en los municipios de La Solana, Tomelloso y el Parque Natural de Las Lagunas de Ruidera
Enrique Díaz-Cano Alhambra, Jorge Mateo Sotos, Ana María Torres Aranda

13:15h S4.2.5 Algoritmo de control de carga basado en calidad de experiencia en redes LTE
María Luisa Marí-Altozano, Salvador Luna-Ramírez, Matías Toril

13:30h S4.2.6 Asignación automática de portadoras en un escenario 5G
I. de-la-Bandera, D. Palacios, R. Barco

13:45h S4.2.7 Algoritmo de detección interior/exterior para trazas de conexión de una red LTE
J. L. Bejarano-Luque, M. Toril, M. Fernández-Navarro, R. Acedo-Hernández, S. Luna Ramírez

SESIÓN 4.3: Sesión especial: Premio URSI 2018 a Jóvenes Investigadores

JUEVES, 12:15-14:00
Presidentes de sesión: **Francisco Medina Mena y Jordi Romeu Robert**
Lugar: Sala Andalucía III

12:15h S4.3.1 Outline of a Radiofrequency Energy Harvesting System Based on an Ultrawideband Archimedean Spiral Antenna
Antonio Alex-Amor, Pablo Padilla, José M. Fernández-González, Manuel Sierra-Castañer

12:30h S4.3.2 V-band aperture array antenna using gap waveguide technology based on glide-symmetric structures
Ángel Palomares Caballero, Pablo Padilla de la Torre, Juan Valenzuela-Valdés

12:45h S4.3.3 A Novel Reconfigurable Phase Shifter based on Substrate Integrated Coaxial Line using Liquid Crystal
Vicente Nova, Carmen Bachiller, Juan R. Sánchez and Vicente Boria

13:00h S4.3.4 3D Bifocal Design Method for Dual Reflectarray Configurations with Application to Multi-Beam Satellite Antennas in Ka-Band
Eduardo Martínez de Rioja, José A. Encinar, Rafael Florencio Díaz, Carolina Tienda

13:15h S4.3.5 Conformal Patch Array Antenna with Switchable Omnidirectional or Sectorial Coverage at 3.5 GHz

P. Sánchez-Olivares, P. P. Sánchez-Dancausa, J. L. Masa-Campos, M. Iglesias-Menéndez de la Vega and E. García-Marín

13:30h S4.3.6 Microwave Filter on a Decoupled Empty Substrate Integrated Waveguide

Juan R. Sánchez, Carmen Bachiller, Vicente Nova and Vicente E. Boria

13:45h S4.3.7 Monopulse Space Debris Radar Antenna Based on RLSA and 3D-Printed Gap Waveguide at 94 GHz

Adrián Tamayo-Domínguez, José-Manuel Fernández-González, Manuel Sierra-Castañer

SESIÓN 4.4: Componentes y Circuitos Activos de Microondas

JUEVES, 12:15-14:00
Presidentes de sesión: **Javier Reina Tosina y María Nieves Ruiz Lavín**
Lugar: Seminario 1+2

12:15h S4.4.1 A Comprehensive Performance Benchmark of Component Selection Techniques for Volterra Behavioral Models

Abraham Pérez-Hernández, Juan A. Becerra, María J. Madero-Ayora, Carlos Crespo-Cadenas

12:30h S4.4.2 Algoritmo Subspace Pursuit para la Selección de Parámetros de Modelos de Volterra

Juan A. Becerra, María J. Madero-Ayora, Abraham Pérez-Hernández, Javier Reina-Tosina, Carlos Crespo-Cadenas

12:45h S4.4.3 Amplificador de Alta Potencia 6-18 GHz en GaN sobre SiC para Guerra Electrónica

Eduardo Oreja Gigorro, Emilio Delgado Pascual, Juan José Sánchez Martínez, María Luz Gil Heras, Virginia Bueno Fernández, Antonio Bódalo Márquez, Jesús Grajal

13:00h S4.4.4 Distorsión No Lineal en Amplificadores de Potencia de Banda Ancha en GaN

Emilio Delgado Pascual, Eduardo Oreja Gigorro, Juan José Sánchez Martínez, María Luz Gil Heras, Virginia Bueno Fernández, Antonio Bódalo Márquez, Jesús Grajal

13:15h S4.4.5 Predicción de los Contornos Load-Pull en un Amplificador Clase-E mediante un Modelo de tipo Conmutador

David Vegas, María Oti, María Pampín, José R. Pérez-Cisneros, M. Nieves Ruiz, José A. García

13:30h S4.4.6 Transmisor Outphasing Clase-E de Alta Eficiencia en Tecnología GaN HEMT

David Vegas, Miguel A. González, José R. Pérez-Cisneros, M. Nieves Ruiz, José A. García

13:45h **S4.4.7 Corrección de desequilibrios basado en envolvente elíptica para Unidades Radio Remotas LINC en arquitecturas C-RAN con Fronthaul Óptico.**
Pedro L. Carro, Paloma García-Dúcar, Jesús de Mingo, Antonio Valdovinos, Ángela Hernández, Fernando Gutiérrez

SESIÓN 4.5: Sesión especial: Ongoing research towards 5G (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Jorge Navarro Ortíz y Eduardo Jacob**
Lugar: Seminario 3+4

12:15h **S4.5.1 Identificación de eventos sociales como la causa de fallo en redes celulares**
Sergio Fortes, Hao Qiang Luo-Chen, Eduardo Baena, Inmaculada Serrano, Raquel Barco

12:30h **S4.5.2 Reducción de dimensionalidad en funciones SON mediante técnicas de extracción de atributos**
D. Palacios, I. de-la-Bandera, R. Barco

12:45h **S4.5.3 Estimación del Offset Temporal en Sistemas Multiportadora Basados en la DCT**
Fernando Cruz–Roldán, José Piñeiro–Ave, José L. Rojo-Álvarez, Manuel Blanco–Velasco

13:00h **S4.5.4 A low cost drone based multifunction DMR repeater for emergencies**
Eduardo Jacob, Juan Jos Unzilla, Jasone Astorga, Maider Huarte

13:15h **S4.5.5 The Roll of Data Distribution Service in Failure-aware SDN Controllers**
Alejandro Llorens-Carrodeguas, Cristina Cervelló-Pastor, Irian Leyva-Pupo, Juan Manuel López-Soler, Jorge Navarro-Ortiz

13:30h **S4.5.6 Flexible services deployment using Small Unmanned Aerial Vehicles for emergency situations**
Víctor Sanchez-Aguero, Borja Nogales, Francisco Valera, Iván Vidal

13:45h **S4.5.7 A Framework for Latency-constrained Edge Nodes Placement in 5G Networks**
Alejandro Santoyo-González, Cristina Cervelló-Pastor

SESIÓN 4.6: Sesión especial: Comunicaciones por satélite (Parte 2)

JUEVES, 12:15-14:00
Presidentes de sesión: **Miguel A. Salas Natera y Ramón Martínez Rodríguez-Osorio**
Lugar: Seminario 6

12:15h **S4.6.1 Comparison between Regular and Irregular Beams of VHTS Satellites in NonUniformed Traffic Scenarios**
Flor G. Ortíz, Daniel de la Torre, Ramón Martínez, Miguel Salas, Salvador Landeros

12:30h **S4.6.2 Performance evaluation of High Throughput Satellites (HTS) on suburban scenarios**
Luis Ventureira Gómez, Ramón Martínez Rodríguez-Osorio, Flor de Guadalupe Ortiz Gómez, Manuel García Sánchez

12:45h **S4.6.3 Optimización del Segmento Terrestre para un Sistema Satelital UHTS mediante Redes Neuronales**
Andrés Cornejo, Salvador Landeros, Ramón Martínez Rodríguez-Osorio, José María Matías

13:00h **S4.6.4 Circularly Polarized Active Antenna Array System Calibration for Improved Axial Ratio Performance**
Miguel A. Salas-Natera, Ramón Martínez Rodríguez-Osorio, Leandro de Haro, and Manuel Sierra Pérez

13:15h **S4.6.5 Quad-Band Inductive Frequency Selective Surface: An application for satellite communications**
Juan Andrés Vásquez Peralvo, José Manuel Fernández González

13:30h **S4.6.6 Improvement on Side Lobe Level for Self-Supported Sub-reflector Fed Antenna Systems**
Miguel A. Salas-Natera, Ramón Martínez Rodríguez-Osorio, Leandro de Haro and Binoy Noir

SESIÓN 5.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Salvador González García y Mario Fernández Pantoja**
Lugar: Sala Andalucía I

15:30h **S5.1.1 Macrobases desacopladas en potencia para el método de los momentos de dispersores dieléctricos**
Luis Landesa, Alberto Serna, José M. Taboada

15:45h **S5.1.2 Método de Momentos para estructuras periódicas multicapa con anillos partidos y su aplicación al diseño de reflectarrays con polarización circular**
Rafael Florencio Díaz, Rafael Rodríguez Boix, José A. Encinar Garcinuño

16:00h **S5.1.3 Modelo de Circuito para Rejilla de Difracción Plana de Tipo *Echelle***
C. Molero, R. Rodríguez-Berral, F. Medina, F. Mesa, M. Memarian, T. Itoh

16:15h **S5.1.4 A Subcell FDTD Scheme implementation for narrow apertures modeling**
Miguel R. Cabello, Luis D. Angulo, Mario F. Pantoja, Amelia R. Bretones, Rafael G. Martín, J. Álvarez, Salvador G. García

16:30h **S5.1.5 Application of advanced simulations in time domain in the EMC certification process of an aircraft**
Enrique Pascual Gil, Guadalupe Gutiérrez Gutiérrez, Raúl Molero Castejón

SESIÓN 5.2: Comunicaciones Móviles e Inalámbricas (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Francisco Falcone Lanas y Ana M. Torres Aranda**
Lugar: Sala Andalucía II

15:30h **S5.2.1 Evaluación del rendimiento del servicio de videostreaming adaptativo en redes inalámbricas**
Luis Roberto Jiménez, Marta Solera Delgado, Matías Toril Genovés

15:45h **S5.2.2 Herramienta de planificación radio para evaluar la calidad de experiencia en redes móviles**
P. A. Sánchez, J. L. Bejarano-Luque, J.F. Cantón, M. Toril, S. Luna-Ramírez

16:00h **S5.2.3 Marco funcional para la gestión de slicing en la red de acceso radio 5G**
R. Ferrús, O. Sallent, J. Pérez-Romero

16:15h **S5.2.4 Optimización de la QoE de un servicio de vídeo streaming en un entorno celular**
J. Mendoza, A. Herrera, D. Palacios, I. de-la-Bandera y R. Barco

16:30h **S5.2.5 Sistema de Localización de Dispositivos Android basado en Redes GSM**
Luis Alberto Martínez Hernández, Sandra Pérez Arteaga, Linda Karina Toscano Medina, Gabriel Sánchez Pérez, Ana Lucila Sandoval Orozco

16:45h **S5.2.6 Un nuevo criterio basado en calidad de experiencia para el balance de carga en redes LTE**
C. Gijón, S. Luna-Ramírez, M. Toril

17:00h **S5.2.7 Simulador de 5G a partir del generador de canal QuaDRiGa**
Francisco Jesús Quero de la Rosa, Pablo Muñoz Luengo, Juan Francisco Valenzuela Valdés

SESIÓN 5.3: Sesión especial: In memoriam Prof. Dr. Mariano Barba Gea

JUEVES, 15:30-17:15
Presidentes de sesión: **José Antonio Encinar Garcinuño y Eduardo Carrasco Yépez**
Lugar: Sala Andalucía III

15:30h **S5.3.1 Antenas tipo reflectarray con control electrónico del haz mediante diodos PIN y conmutadores MEMS: contribuciones de Mariano Barba Gea**
Eduardo Carrasco, José A. Encinar

15:45h S5.3.2 Contribución de Mariano Barba Gea al diseño y prototipado de antenas reflectarray
José A. Encinar, Manuel Arrebola, Eduardo Carrasco, Gerardo Pérez-Palomino

16:00h S5.3.3 Diseño de un Combinador Radial de Potencia de 16 Vías en Banda Ku mediante el Modo Circular TE_{01}
José R. Montejo-Garai, Irene O. Saracho-Pantoja, Jorge A. Ruiz-Cruz, Jesús M. Rebollar

16:15h S5.3.4 Diseño de un Filtro Comb-Line en el Taller de Sistemas de Comunicaciones
Ana Buesa-Zubiria

16:30h S5.3.5 Technological Developments for a Space-borne Orbital Debris Radar at 94 GHz
Marta Ferreras, Mario Ramírez-Torres, Clara Hernández, Carlos García-de-la-Cueva, Mariano Barba, Gerardo Pérez-Palomino, José A. Encinar, Manuel Sierra-Castañer, Jesús Grajal, José-Luis Vázquez-Roy and Eva Rajo-Iglesias

16:45h S5.3.6 Contribución de Mariano Barba Gea al Diseño y Validación de Reflectarrays Reconfigurables basados en Cristal Líquido
Gerardo Pérez-Palomino, Xabi Quintana, Eduardo Carrasco, Morten. A Geday, José. A Encinar

SESIÓN 5.4: Sesión especial: Técnicas y tecnologías de fabricación para dispositivos en RF

JUEVES, 15:30-17:15
Presidentes de sesión: **Eva Rajo Iglesias y Alejandro Valero Nogueira**
Lugar: Seminario 1+2

15:30h S5.4.1 3D printed Horn Antenna for Space and Telecommunications
Jorge Teniente-Vallinas, Juan Carlos Iriarte-Galarregui, Rubén Caballero-Nagore, Daniel Valcazar-Berdofe, Mikel Goñi-Esparza and Aitor Martínez-Agoües

15:45h S5.4.2 Corrección de errores en la fabricación de dispositivos en guía vacía integrada en substrato (ESIW) y línea coaxial vacía integrada en substrato (ESICL)
Juan Ángel Martínez, Ángel Belenguer, Alejandro L. Borja, Héctor Esteban, y Vicente E. Boria

16:00h S5.4.3 Diseño de Componentes en Guía de Onda para Banda W mediante Tecnología de Foto Resina SU-8
Carlos A. Leal-Sevillano, Yingtao Tian, Michael J. Lancaster, Jorge A. Ruiz Cruz, José R. Montejo Garai, Jesús M. Rebollar

16:15h S5.4.4 Fabricación por Diffusion Bonding de Agrupaciones de Antenas en Guía de Onda para Banda W
E. García-Marín, J.L. Masa-Campos, P. Sánchez-Olivares

16:30h S5.4.5 Micromachining of High Frequency Components at ISC/UPNA
Jorge Teniente-Vallinas, Rubén Caballero-Nagore, José Manuel Pérez-Escudero, Alicia Torres-García, Javier Chocarro Álvarez, Adrián Gómez-Torrent

16:45h S5.4.6 Técnicas de Fabricación Avanzadas en Tecnología LTCC para Aplicaciones de Microondas y Onda Milimétrica
Mariano Baquero Escudero, Jorge Daniel Martínez Pérez

17:00h S5.4.7 Técnicas de fabricación aditiva aplicadas al diseño de circuitos planares de radiofrecuencia
Héctor García Martínez, Ernesto Ávila Navarro, Germán Torregrosa Penalva

SESIÓN 5.5: Sesión especial: Ongoing research towards 5G (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Jorge Navarro Ortíz y David Rincón Rivera**
Lugar: Seminario 3+4

15:30h S5.5.1 Fully Synchronous SDN (FSS): Towards Synchronization-as-a-Service in 5G Networks
Raúl Suárez, David Rincón, Anna Agustí, Sebastià Sallent

15:45h S5.5.2 New Radiofrequency Technologies for 5G Systems
M. Sierra Castañer, R. Martínez Rodríguez-Osorio, M. García Sánchez, C. Briso Rodríguez, Juan Moreno, M. Gómez Laso, I. Arnedo, J.L. Masa Campos, A. Tamayo Domínguez, M. Sierra Pérez, B. Galocha Iragüen, J.M. Fernández González, M. Calvo Ramón, J.L. Besada Sanmartín, J.L. Fernández Jambrina, M. Vera Isasa, I. Cuiñas Gómez, A. Vázquez Alejos, E. Lemos Cid, E. García Marín

16:00h S5.5.3 P4ON: A 5G-Aware P4-Based PON Architecture
Adebanjo Haastrup, David Rincón, Hamzeh Khalili, Sebastià Sallent

16:15h S5.5.4 SDN-based Management of Time-Sensitive Networks in 5G Fronthaul
Feliu Castaño, Oriol Castaño, Gabriel Anangonó, David Rincón, Anna Agustí

16:30h S5.5.5 A Framework for Placement and Optimization of Network Functions in 5G
Irian Leyva-Pupo, Cristina Cervelló-Pastor, Alejandro Llorens-Carrodeguas

SESIÓN 5.6: Sesión especial: Tecnologías en Milimétricas y Terahercios para Comunicaciones y Sensorización

JUEVES, 15:30-17:15
Presidentes de sesión: **José María Molina García-Pardo y Lluis Jofre Roca**
Lugar: Seminario 6

15:30h S5.6.1 Full-vector analytical coupling model of mm-wave whispering-gallery resonances in sphere

Gabriel Santamaría-Botello, Kerlos A. Abdalmalak, Alejandro Rivera-Lavado, Daniel Segovia-Vargas, Luis Enrique García Muñoz

15:45h S5.6.2 W-band Near-Field Vehicle Synthetic Aperture Radar Imaging for Urban Environments

Martín Trullenque, María-Teresa Martínez-Inglés, Christian Ballesteros, Andreas Pfadler, Jordi Romeu, José-María Molina-García-Pardo, Antonio Mateo Aroca y Lluís Jofre

16:00h S5.6.3 Theoretical and Experimental Study at 60 and 94 GHz in Indoor Environments

María-Teresa Martínez-Inglés, Davy Gaillot, Juan Pascual García, José-María Molina-García-Pardo and José-Víctor Rodríguez, Leandro Juan Llácer, Miguel Ferrando

16:15h S5.6.4 440 GHz fabrication of a Slotted-Waveguide Antenna based on Gap Waveguide Technology

Rubén Caballero-Nagore, Jorge Teniente-Vallinas, Miguel Ferrando-Rocher and Alejandro Valero-Nogueira

16:30h S5.6.5 Terahertz detection using strained silicon FET: Front and back illumination

J. Delgado Notario, J.E. Velázquez, J. Calvo, Miguel Ferrando Bataller, K. Fobelets and Y.M. Meziani

16:45h S5.6.6 Medición de materiales con radiación THz

Andrés Felipe Escobar Mejía, Juan Pablo Ciafardini, José Alberto Bava, Jorge O. Tocho

SESIÓN 6.1: Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 1)

VIERNES, 9:15-10:30
Presidentes de sesión: **Luz García Martínez y Sonia Mota Fernández**
Lugar: Sala Andalucía I

9:15h S6.1.1 Extracción y clasificación de características a partir de señales EEG

Francisco Laport, Paula M. Castro, Francisco J. Vázquez-Araujo, Adriana Dapena, José J. Lamas-Seco

9:30h S6.1.2 LitterDrone: monitorización de basura marina empleando drones y análisis de imagen

Fernando Martín-Rodríguez, Laura Rodríguez-Barreiro, Marta Fernández-Bastos, Gema Martínez Iglesias

9:45h S6.1.3 An advanced mixed-signal processing platform with high performance SoCs

Pablo Garrido-Sánchez, José Carlos Martínez-Durillo, Andrés Roldán Aranda

10:00h S6.1.4 classifying volcano-seismic signals: a comparative study based on deep learning approaches

Manuel Titos, Ángel Bueno, Luz García, Isaac Álvarez, Carmen Benítez, Jesús Ibáñez

10:15h S6.1.5 Influencia del Modelado de Obstáculos en la Difracción Múltiple de Ondas Acústicas

Domingo Pardo Quiles, Rubén Lozano Giménez, José-Víctor Rodríguez, Leandro Juan-Llácer y María-Teresa Martínez-Inglés

SESIÓN 6.2: Componentes y Circuitos Pasivos de Microondas (Parte 1)

VIERNES, 9:15-10:30
Presidentes de sesión: **José Ramón Montejo Garai y Rafael Rodríguez Boix**
Lugar: Sala Andalucía II

9:15h S6.2.1 Power Divider and 90º Hybrid Directional Coupler in Empty Substrate Integrated Coaxial Line

José M. Merello, Vicente Nova, Carmen Bachiller, Juan R. Sánchez and Vicente E. Boria

9:30h S6.2.2 Design of passive network for a Single Balanced Mixer at 90 GHz with low LO power supply

Alberto-José Moreno-Montes, Alejandro Rivera-Lavado, Guillermo Carpintero, Luis-Enrique García-Muñoz, Daniel Segovia-Vargas

9:45h S6.2.3 Rectena de banda ancha para la recolección de energía electromagnética ambiental

Ana López Yela, Daniel Segovia Vargas, Vicente González Posadas

10:00h S6.2.4 Experimental Design of a 2.45-GHz Patch Antenna Array for RF Energy Harvesting

Natalia Marcos-Iglesias, Jorge M. Villar, Yolanda Campos-Roca, Luis Landesa

10:15h S6.2.5 RF-DC rectifiers for energy harvesting from GSM and WiFi bands

Jorge M. Villar, Natalia Marcos-Iglesias, Yolanda Campos-Roca, Luis Landesa

SESIÓN 6.3: Sesión especial: Compatibilidad electromagnética

VIERNES, 9:15-10:30
Presidentes de sesión: **Antonio Lozano Guerrero y Juan Vicente Balbastre Tejedor**
Lugar: Sala Andalucía III

9:15h S6.3.1 Apantallamiento Electromagnético de Materiales Planares en Guía de Onda en Régimen Multimodal

Antonio José Lozano-Guerrero, Marina-Carricondo-Chalud, Juan Vicente Balbastre Tejedor, Mohamed Sidi Benhamou, Juan Monzó-Cabrera, and Alejandro Díaz-Morcillo

9:30h S6.3.2 Calculation and Reduction of Parasitic Inductances of Film Capacitors
P. González-Vizuete, F. Fico, M.J. Freire, J. Bernal

9:45h S6.3.3 Characterization of Common Mode Chokes at High-Frequencies for Aeronautical Applications
C. Domínguez-Palacios, J. Bernal, M. M. Prats

10:00h S6.3.4 Experimental Evaluation of a Printed Circuit Board Electromagnetic Model
Antonio José Lozano-Guerrero, Antonio Albero-Ortiz, Juan Monzó-Cabrera and Alejandro Díaz-Morcillo

10:15h S6.3.5 Topside Electromagnetic Compatibility (EMC) of Communication Systems in the V/UHF Frequency Band
David Larios, Victor F. Martín, F. Obelleiro, J.L. Rodríguez and José M. Taboada

SESIÓN 6.4: Sesión especial: Comunicaciones móviles, planificación y optimización de redes

VIERNES, 9:15-10:30
Presidentes de sesión: **Pablo Muñoz Luengo e Isabel de la Bandera Cascales**
Lugar: Seminario 1+2

9:15h S6.4.1 Arquitectura de Red de Comunicaciones Inalámbricas para la Industria 4.0
M.C. Lucas-Estañ, M. Sepulcre, J. Gozálvez

9:30h S6.4.2 Evaluación del protocolo Listen Before Talk en el estándar 3GPP Licensed Assisted Access
Eduardo Baena, Sergio Fortes, Raquel Barco

9:45h S6.4.3 Clasificación de tráfico encriptado mediante aprendizaje no supervisado en redes LTE
J.F. Cantón, J.L. Bejarano-Luque, P.A. Sánchez, M. Toril

10:00h S6.4.4 Mejora de la eficiencia energética en redes 5G mediante el apagado inteligente de celdas
Francisco Luna, Rafael M. Luque Baena, Jesús Martínez, Juan F. Valenzuela-Valdés, Pablo Padilla

10:15h S6.4.5 Modelado de TCP en un entorno celular con Dual Connectivity
J. Burgueño, I. de la Bandera, D. Palacios, R. Barco

SESIÓN 6.5: Antenas (Parte 2)

VIERNES, 9:15-11:00
Presidentes de sesión: **Pablo Sánchez Olivares y José Luis Masa Campos**
Lugar: Seminario 3+4

9:15h S6.5.1 A Study on Monopulse Errors for an Active, Electronically Controlled Beam Steering, Truncated Pyramid, Phased Array for IFF Applications
A. Álvarez Mellado, C. Zarzuelo Torres, A. Asensio López, J. Gismero Menoyo, M. Sierra Pérez

9:30h S6.5.2 Miniaturized Top-Metallized Rectangular Dielectric Resonator Antenna
Mario Pérez-Escribano, Francisco Javier Herraiz-Martínez and Enrique Márquez-Segura

9:45h S6.5.3 Novel Reflectarray Cells For Transmit and Receive Multi-Spot Satellite Antennas in Ka Band
Daniel Martínez de Rioja, José A. Encinar, Rafael Florencio, Rafael R. Boix

10:00h S6.5.4 Técnica de Mejora de Ganancia y Relación Axial para Antenas Espirales Compactas
Andrea García Estellés, Juan José Sánchez Martínez, Ana Cristina Gago-Lancho, Francisco Vázquez Vázquez

10:15h S6.5.5 Antena Bi-banda con Conformación de Dos Haces Simultáneos Para Sistemas GNSS-R
R. Onrubia, D. Pascual, J. Querol, H. Park, A. Camps

10:30h S6.5.6 Estudio electromagnético de una antena de parche rectangular acoplada por abertura con stub rectangular
Yordanis Alonso-Roque

10:45h S6.5.7 Estudio de la geometría de una apertura coaxial para su uso en un microscopio por microondas escáner en campo próximo
José D. Gutiérrez-Cano, José M. Catalá-Civera, Pedro Plaza-González, Gabriel Llorens Vallés, Felipe L. Peñaranda-Foix

SESIÓN 6.6: Sesión especial: Bioingeniería y e-health

VIERNES, 9:15-10:30
Presidentes de sesión: **Miguel Ángel López Gordo y Jesús Minguillón Campos**
Lugar: Seminario 6

9:15h S6.6.1 Diseño centrado en usuario para e-Salud: Sistema e-Nefro
Jorge Calvillo Arbizu, Isabel Román Martínez, Javier Reina Tosina

9:30h S6.6.2 Cloud Data Base Construction Method for Speed Diagnosis of Infectious Diseases
Alberto Garcés, Vera Pospelova, José Luis Castillo Sequera, José Manuel Gómez-Pulido, José María Gutiérrez Martínez, María-Luz Polo-Luque

9:45h S6.6.3 Neuroingeniería lúdica e inclusión
Eduardo Pérez Valero, Jesús Minguillón, Miguel Ángel López Gordo

10:00h S6.6.4 Estudio de la detección de caídas utilizando el algoritmo SVM
José Antonio Santoyo Ramón, Eduardo Casilari Pérez, José Manuel Cano García

10:15h S6.6.5 UWB 3D Printed Microwave Stethoscope Antenna for Body Sensing
Saba Rashid, A. Garrido, A. Aguasca, S. Blanch, Y. Ding, J. Romeu, L. Jofre

SESIÓN 7.1: Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 2)

VIERNES, 10:45-11:30
Presidentes de sesión: **Sonia Mota Fernández y Luz García Martínez**
Lugar: Sala Andalucía I

10:45h S7.1.1 New strategies for recording Auditory Brainstem Responses and Middle Latency Responses
Marta Martínez, Isaac M. Álvarez, Joaquín T. Valderrama, Ángel de la Torre, José Luis Vargas, Luz García, Manuel Titos, Ángel Bueno

11:00h S7.1.2 Sistema de ayuda a la interpretación de partituras musicales mediante MIDI y códigos QR
M. Morales, B. Rodríguez, J. Cañete, J. Rivas, A. Peinado

11:15h S7.1.3 Algoritmo de adaptación DASH sensible al tamaño del segmento
Román Belda, Ismael de Fez, Pau Arce, Juan Carlos Guerri

SESIÓN 7.2: Componentes y Circuitos Pasivos de Microondas (Parte 2)

VIERNES, 10:45-11:30
Presidentes de sesión: **José Ramón Montejo Garai y Rafael Rodríguez Boix**
Lugar: Sala Andalucía II

10:45h S7.2.1 Alimentador compacto basado en un polarizador septum para antena MTS de doble polarización
A. Tellechea, J. Teniente, R. Gonzalo, I. Ederra y J.C. Iriarte

11:00h S7.2.2 Desfasador Sintonizable con Postes Metálicos en Guía de Onda Rectangular con Fabricación Aditiva
Lucas Polo-López, J.L. Masa-Campos, Jorge A. Ruiz-Cruz

11:15h S7.2.3 Filtro de Doble-Banda en Tecnología Inverted Microstrip Gap Waveguide integrado con una Antena de Ranura
L. Inclán-Sánchez

SESIÓN 7.3: Sesión especial: Radioastronomía

VIERNES, 10:45-11:30
Presidentes de sesión: **Mª Luisa de la Fuente Rodríguez**
Lugar: Sala Andalucía III

10:45h S7.3.1 Optimización de la Quad-Ridge Flared Horn para la estación VGOS del Observatorio de Yebes
A. Baldominos, Ó. García-Pérez, F. Tercero, J. M. Serna, B. Vaquero

11:00h S7.3.2 Forty GHz Instrument polarimeter receiver for Cosmic Microwave Background observations
Eduardo Artal Latorre, Enrique Villa Benito, Juan Luis Cano de Diego, Beatriz Aja Abelán, Luisa de la Fuente Rodríguez, José Vicente Terán Collantes, Angel Mediavilla Sánchez

11:15h S7.3.3 Receptor Interferométrico para Radioastronomía de 10 a 20 GHz
L. de la Fuente, B. Aja, E. Villa, E. Artal, J.L. Cano, A. Mediavilla

SESIÓN 7.4: WORKSHOP: Simulación FDTD en EMC mediante SEMBA

VIERNES, 10:45-11:45
Lugar: Seminario 1+2
Dirigen: Alejandra L. Aberasturi, Luis D. Angulo, Miguel R. Cabello, Salvador G. García

RESÚMENES DE LAS PONENCIAS

SESIÓN 1.1: Metamateriales y Metasuperficies

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **Óscar Quevedo Teruel y Gregorio José Molina Cuberos**
Lugar: Sala Andalucía I+II+III

9:30h S1.1.1 Caracterización de la frecuencia de resonancia de un metamaterial quiral formado por manivelas de cinco segmentos

J. M. Cuadrado Ochotorena[1], G. J. Molina-Cuberos[2], A. J. García-Collado[3], J. Margineda[2]
[1]Grado en Física, Universidad de Murcia
[2]Dpto. de Electromagnetismo y Electrónica, Universidad de Murcia, Murcia
[3]Geomática, Teledetección y SIG Aplicados, Universidad Católica de Murcia

Abstract: A chiral metamaterial composed by a periodical arrangement of five segments cranks has been designed and its electromagnetic response for linearly polarized waves under normal incidence was simulated. The unit cell is composed by four basic resonators with two cranks each in order to ensure C4 symmetry and, therefore, normal axial symmetry. A parametric analysis has been performed to know the relation between the resonance frequency and the geometrical parameters of the structure. As result, an analytical expression for the frequency resonance was obtained which allows building metamaterials with a selective operating band.

9:45h S1.1.2 Design Methodology of Dual-Band Single-Layer Leaky Wave Antennas

Nausika Memeletzoglou[1], Darwin Blanco Montero[2] , Eva Rajo-Iglesias[1]
[1]Dept. Signal Theory and Communications, University Carlos III of Madrid, Spain
[2]THz Sensing Group, Dept. of Microelectronics, Delft University of Technology, The Netherlands

Abstract: A new method for designing dual-band leaky-wave antennas (Fabry-Perot type) is presented in this work. The methodology is based on the use of pure inductive and pure capacitive metasurfaces (MTS) as superlayers that are equivalent to a given dielectric slab (with a given ε). Furthermore, the method allows to have control on the directivity of the antenna at each one of the frequency bands. Two examples of designs in Ka band are presented.

10:00h S1.1.3 Estructuras electromagnéticas con simetrías helicoidales

O. Quevedo-Teruel, O. Dahlberg , Q. Chen, F. Ghasemifard
Electromagnetic Engineering Department, KTH Royal Institute of Technology, Stockholm, Sweden.

Abstract: In this is paper, we introduce the concept of periodic electromagnetic structures with twist symmetries. Moreover, we provide an explanation of their electromagnetic properties, and their potential use for practical applications, such as low dispersive leaky-wave antennas and the fully-metallic filters.

10:15h S1.1.4 Implementación de antena leaky-wave basada en metasuperficie de Huygens

Elena Abdo-Sánchez[1], Ariel Epstein[2], George V. Eleftheriades[3]
[1]Dpto. Ing. Comunicaciones, E.T.S.I. Telecomunicación, Universidad de Málaga, Andalucía Tech

[2]Andrew and Erna Viterbi Faculty of Electrical Engineering, Technion - Israel Institute of Technology, Israel
[3]The Edward S. Rogers Sr. Department of Electrical and Computer Engineering, University of Toronto, Canada

Abstract: In this communication, the implementation of a leaky-wave antenna based on bianisotropic Huygens' metasurface is addressed. It consists of a parallel-plate waveguide in which the top plate is replaced by a metasurface. It was previously shown that, by properly designing the metasurface, arbitrary control on the radiation parameters of the leaky mode can be achieved. Closed-form expressions allow getting the constitutive parameters of the required metasurface. However, achieving a physical realization entails several challenges, discussed in this contribution.

SESIÓN 1.2: Sesión especial: Canal de propagación (Parte 1)

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **José Manuel Riera Salís y Luis Mendo Tomás**
Lugar: Seminario 1+2

9:30h S1.2.1 Caracterización del canal radio en el interior de un metro a 26, 28, 33 y 38 GHz

Lorenzo Rubio[1], Vicent M. Rodrigo-Peñarrocha[1], Juan Reig[1], Juan Pascual-García[2], José-María Molina-García-Pardo[2] y Leandro Juan-Llacer[2]

[1]Instituto iTEAM, Universitat Politécnica de València
[2]Dpto. Tecnologías de la Información y las Comunicaciones, Universidad Politécnica de Cartagena

Abstract: In this paper we present results of the propagation channel characteristics inside an underground convoy from channel measurements. The measurements were collected from 25 to 40 GHz in the frequency domain using as a novelty a radio over fiber (RoF) link in order to avoid the high losses introduced by cables at these frequencies and allowing long distances between the transmitter and receiver antennas. Path loss, delay spread and coherence bandwidth values are reported at the potential 26-, 28-, 33-, and 38-GHz bands to deploy the future 5G systems. These results allow us to have a better knowledge of the propagation channel characteristics in this particular environment, characterized by rich-scattering with long delays.

9:45h S1.2.2 Análisis de la aplicabilidad de las técnicas de trazado de rayos para analizar canales V2V en entornos complejos.

Rafael P.Torres[1], Jesús R. Pérez[1], Luis Valle[1], J. Basterrechea[1], Marta Domingo[1], Jorge González[1], Herman Fernández[2], Lorenzo Rubio[3], Vicent M. Rodrigo-Peñarrocha[3], Juan Reig[3]
[1]Dpto. de Ingeniería de Comunicaciones Universidad de Cantabria
[2]Escuela de Ingeniería Electrónica, Universidad Pedagógica y Tecnológica de Colombia
[3]iTEAM Research Institute. Universitat Politècnica de Valencia

Abstract: In this work, we analyze the applicability of a geometric-based stochastic (GBS) model based on raytracing techniques to vehicular-to-vehicular (V2V) communications. The accuracy and usefulness of the proposed model is investigated using both simulated results and narrowband channel measurements

at 5.9 GHz. The results show that these type of models can be of interest to evaluate communications protocols and system performance of future vehicular networks.

10:00h S1.2.3 Fundamentos y Aplicaciones del Modelo de Fading κ-μ Shadowed

J. F. París
Dpto. de Ingeniería de Comunicaciones. ETSIT, Universidad de Málaga

Abstract: Recientemente se ha propuesto un nuevo modelo de fading para canales inalámbricos que generaliza los modelos clásicos Rayleigh, Rician, Hoyt y Nakagami-m; además de otros modelos más modernos muy utilizados: Rician shadowed, κ-μ y η-μ. Dicho modelo se conoce como κ-μ shadowed y permite incluir dos fenómenos físicos difíciles de contemplar simultaneamente en modelos de fading tratables analíticamente: existencia de LoS (Line-of-Sight) y fluctuación de potencia en dicha LoS. El modelo ha sido utilizado intensivamente en los ultimos años por numerosos autores como sustitución y generalización del modelo Rician; sorprendentemente, pese a ser en cierto sentido mucho más general que este, el modelo κ-μ shadowed suele conducir a expresiones más simples en el análisis de prestaciones de sistemas de comunicaciones inalámbricas. En esta comunicación se resumen las características y propiedades del modelo κ- μ shadowed, así como sus aplicaciones en el ámbito de las comunicaciones inalámbricas.

10:15h S1.2.4 Clasificación de eventos de lluvia y evaluación de sus efectos sobre la propagación a partir de perfiles radar en banda K

Santiago Pérez Peña, Marta Munilla Díez, José Manuel Riera, Ana Benarroch
Information Processing and Telecommunications Center (IPTC), Universidad Politécnica de Madrid

Abstract: Both the characterization of rainfall phenomena and the prediction of rain attenuation can be improved with the knowledge of experimental drop size distributions (DSDs), which, in turn, depend on the type of rain event (stratiform or convective) and the rain rate. In this paper, data from a vertical Doppler radar (MRR-2) is used together with auxiliary data from other meteorological instruments to classify the rain events that took place in Madrid in a multi-year period, estimate their characteristics and calculate their effect on millimeter-wave radio links. Statistics of DSD are obtained and calculations of attenuation are presented for some example events.

SESIÓN 1.3: Electromagnetismo

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **José Mª Gil y Alejandro Javier Martínez Ros**
Lugar: Seminario 3+4

9:30h S1.3.1 A general procedure for a frequency-stable singularity cancellation in local space for Integral Equations

Fernando Conde-Pumpido, José Mª Gil
Departamento de Señales, Sistemas y Radiocomunicaciones, Universidad Politécnica de Madrid

Abstract: A cancelation of the singular kernel that appears in the Electric Field Integral Equation (EFIE) is derived, using an appropriate coordinate transformation. The Jacobian determinant introduces a multiplicative term that cancels out the weak singularity associated to integrands and softens the kernel and diminishes problems related to higher orders singularities. Then, a novel modification is proposed to complete the cancellation for any order, solving the Ordinary Differential Equation that results from it. A constant is introduced to normalize the integral kernel and keep this method frequency stable. This procedure reduces integration error when applied to the cubature integrals that appear in both EFIE and Magnetic Field Integral Equation (MFIE) formulations, allowing a reliable combination of both (CFIE). The cancellation is carried out over the local domain, being thus compatible with any curved element and any order of basis functions.

9:45h S1.3.2 RCS and Reflectivity Good Agreement in Measured and Simulated Rain

Guillermo D. Rodríguez[1,2], R. Ezequiel García[1,2], Juan P. Ciafardini[2], J. Alberto Bava[2], Miguel Ferrando Bataller[3]
[1]Facultad de Cs. Astronómicas y Geofísicas, Universidad Nacional de La Plata. Argentina.
[2]Facultad de Ingeniería, Universidad Nacional de La Plata. Argentina.
[3]Instituto de Telecomunicaciones y Aplicaciones Multimedia – Universidad Politécnica de Valencia

Abstract: The development of the weather radars is costly as all the radar studies, but besides the object that is observed with this tool is difficult to simulate in a real world and the characteristics of a real rain not ever could be determined completely for the calibration of the radar response. We develop here a software model of a rain, based in real data, in an attempt to use it for a more accurate studies of the polarization parameters and for search others and better ways to determine meteor characteristics. We run simulations of this model exposed to an electromagnetic signal, obtaining as output the Radar Cross Section (RCS) and Reflectivity (Z) of this rain sample and compare these results with the results of the real data used to feed the model.

10:00h S1.3.3 Diseño de un filtro balanceado con doble banda de paso basado en resonadores SIR complejos acoplados magnéticamente

Armando Fernández-Prieto[1], Pedro Ugarte[1], Jesús Martel[2], Aintzane Lujambio[3], Alejandro Martínez-Ros[4], Francisco Medina[1], Rafael R. Boix[1] y Ferrán Martín[5]
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[5]Metamaterials Research Centre for Innovation in Electronics and Communications Technologies (CIMITEC), Departament d´Enginyeria Electronica, Universitat Autónoma de Barcelona

Abstract: In this paper, a compact balanced dual-band band-pass filter with flexible and independent control of the differential-mode response is presented. The filtering mechanism uses magnetically coupled embedded stepped-impedance resonators (ESIRs), which provides two clear advantages: high level of miniaturization and two differential-mode passbands that can be independently tuned. The response of the differential mode is controlled by the external quality factor and coupling coefficients, whereas the common-mode is inherently rejected thanks to the magnetic coupling mechanism. In order to illustrate the benefits of this structure, a prototype example is designed, fabricated and measured. Good differential- and common-mode performance is obtained.

10:15h S1.3.4 Estudio sobre la Convergencia en la Red Multimodal Equivalente para el Análisis de Dispositivos en Guía de Onda

Celia Gómez Molina[1], Fernando Quesada Pereira[1], Alejandro Álvarez Melcón[1], Vicente Boria Esbert[2], Marco Guglielmi[2]
[1]Dpto. de Tecnologías de la Información y las Comunicaciones. Universidad Politécnica de Cartagena
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universidad Politécnica de Valencia

Abstract: In this paper, we present a novel strategy to assess convergence when the Multimode Equivalent Network technique is used in the analysis of waveguide devices. The equivalent network formulation is reviewed to show the specific numerical parameters that are needed to be adjusted. On this basis, a more intuitive and efficient procedure for choosing these parameters to reach accurate results is detailed. Following this mechanism, the user has to set only one global numerical variable, and the specific convergence parameters of each discontinuity are automatically adjusted to give a specific level of numerical accuracy. This leads to both computational efficiency and numerical accuracy of the results. Moreover, the user experience is significantly improved, since all lengthy convergence tests previously needed to assure good numerical accuracy are no longer necessary. In addition to theory, a microwave filter example is analyzed, showing good agreement in comparison to other commercial software results, thus fully validating the theoretical formulation.

SESIÓN 1.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 1)

MIÉRCOLES, 9:30-10:30
Presidentes de sesión: **Ángel San Blas Oltra y Ángela Coves Soler**
Lugar: Seminario 6

9:30h S1.4.1 Análisis, diseño e implementación de un nuevo filtro SIW basado en secciones dieléctricas alternas

Juan R. Sánchez, Carmen Bachiller, María Julia, Vicente Nova, Héctor Esteban y Vicente E. Boria
Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universitat Politecnica de València

Abstract: Este artículo presenta un método modal para el análisis y diseño eficiente y preciso de filtros de microondas, implementados en guía de ondas integrada en sustrato (SIW), basados en secciones dieléctricas alternas. Estas secciones son guías de onda con y sin material dieléctrico que implementan, respectivamente, las cavidades resonantes y las ventanas de acoplo del filtro de cavidades directamente acopladas propuesto. Esta topología permite diseñar y fabricar fácilmente filtros compactos con menores perdidas y mayor ancho de banda de rechazo que otras realizaciones SIW disponibles. Para validar tanto la herramienta de análisis como la topología del filtro, se ha diseñado y fabricado un prototipo de filtro paso-banda de 4 polos, basado en secciones SIW dieléctricas alternas, que presenta muy buenos resultados.

9:45h S1.4.2 Síntesis y diseño de filtros paso-bajo reconfigurables en SIW para aplicaciones espaciales

Clara Máximo Gutiérrez[1], Alejandro Álvarez Melcón[1], Juan Hinojosa Jiménez[2]
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[2]Dpto. de Electrónica, Tecnología de Computadoras y Proyectos, Universidad Politécnica de Cartagena

Abstract: This contribution presents the design of low-pass filters in substrate integrated waveguide (SIW) technology, as alternative to classical band-pass filters. The comparison between the two types of filters will be carried out through the implementation of four designs in SIW technology with different widths of the waveguide and with the use of two different synthesis techniques. The paper also proposes the design of a third degree Chebyshev low-pass filter in SIW technology with reconfiguration capability, with a tuning of the filter cut-off frequency of 150 MHz.

10:00h S1.4.3 Diseño de filtros paso banda en tecnología guía de onda mediante fabricación aditiva

José María García Barceló[1], Alejandro Pons Abenza[1], Alejandro Álvarez Melcón[1], Fernando D. Quesada Pereira[1], Juan Hinojosa Jiménez[2]
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[2]Dpto. de Electrónica, Tecnología de Computadoras y Proyectos. Universidad Politécnica de Cartagena

Abstract: In this work, the design procedure for bandpass filters using dielectric cavities and air holes is described. The dielectric cavities and air holes are obtained by means of a additive manufacturing technique. Two C-band bandpass filters have been designed using ABSplus, a dielectric material commonly employed by 3D-printers with Fused Deposition Modelling (FDM) techniques. Insertion of a metallic probe in one of the filter designed has been carried out, achieving the equalization of the group delay. Considerations for the practical realisation of the filter are presented, in order to deal with typical problems of additive manufacturing (such as accuracy or surface roughness). Two dielectric waveguides have been manufactured at UPCT employing ABSplus. Metallic and dielectric housings will be manufactured in the near future and the filters will be measured by a Vector Network Analyzer.

10:15h S1.4.4 Diseño práctico de un filtro paso-banda empleando una estructura SIW periódica

David López Navarro[1], Ángela Coves Soler[1], Enrique Bronchalo Bronchalo[1], German Torregrosa Peñalva[1] y Maurizio Bozzi[2]
[1]Dpto. de Ingeniería de Comunicaciones. Universidad Miguel Hernandez de Elche
[2]Department of Electrical, Computer and Biomedical Engineering, University of Pavia, Italy

Abstract: The design of a band-pass filter, based on an Electromagnetic Band-Gap (EBG) waveguide in SIW technology with rectangular perforations of the dielectric substrate, is successfully addressed in this work. The effect of the dimensions of the rectangular perforations in the different characteristics of the filter (the lower cutoff frequency, and the center frequency and bandwidth of the rejection-band associated to the first bandgap of the periodic structure) is analysed through the dispersion diagram of the infinitely periodic structure with different unit cells. On the other hand, the number of the periodic cells in the finite implementation of the filter is shown to be directly related to the depth of the rejection band, and also to the number of poles of the filter. A filter operating at 5.6 GHz has been designed,

experimentally validated, and discussed. The proposed approach provides high flexibility, low sensitivity to fabrication inaccuracy, and simple design rules.

SESIÓN 2.1: Antenas (Parte 1)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Adrián Tamayo Domínguez y José Manuel Fernández González**
Lugar: Sala Andalucía I

12:15h S2.1.1 Nuevo enfoque para el diseño de UWB Antenas con radiación de directivas para aplicaciones BAN

Hamza Benchakroun[1,2], Marta Cabedo-Fabrés[2], Adnane Latif[1] ,Miguel Ferrando-Bataller[2]
[1]Information Technology and Modeling Laboratory, National School of Applied Sciences, Cadi Ayyad University, Marrakesh, Morocco
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia, Universitat Politècnica de València

Abstract: Uno de los desafíos más importante de la próxima generación de dispositivos para aplicaciones biomédicas consiste en mejorar la calidad y el rendimiento de redes de área corporal o Body Area Network (BAN). Los sistemas de transmisión de datos de alta velocidad y alta potencia no son apropiados para redes BAN por los excesivos niveles de exposición que conllevan. Alternativamente, se pueden emplear sistemas basados en la tecnología UWB para dispositivos BAN. La adaptación de la antena UWB asegura una buena comunicación de los dispositivos, y si se combina con una buena profundidad de penetración a través del tejido humano, entonces se obtiene el dispositivo perfecto para aplicaciones BAN. En esta comunicación, se presenta una antena de tipo monopolo para BAN. La antena presenta comportamiento UWB y es compacta, gracias al empleo de un reflector y una pared cortocircuitante. Los resultados obtenidos mediante simulación muestran que el diseño de antena propuesto mejora la adaptación de impedancia (S11), el diagrama de radiación y optimiza la profundidad de penetración, teniendo en cuenta de las propiedades dieléctricas de los tejidos humanos. Se han realizado simulaciones colocando la antena cerca de un modelo de cuerpo humano a diferentes distancias. Se ha encontrado que 20 mm es la distancia óptima para obtener un buen compromiso entre adaptación de la antena y la penetración de campo cercano. La antena UWB optimizada presenta una banda de adaptación de más de 10 GHz, con un diagrama de radiación directivo y una buena relación de penetración a través del cuerpo.

12:30h S2.1.2 Design of Broadband Antenna for New Mobile Communication Base Stations

Sergio Martín-Antón, Daniel Segovia-Vargas
GREMA (Group of Radiofrequency, Electromagnetics, Microwaves and Antennas), Signal Theory and Communications Department, Universidad Carlos III de Madrid

Abstract: This paper presents the first design stage of a broadband planar antenna element for new mobile base stations. The objective of the current paper is the design of an antenna working in the extended 5G bandwidth in order to fulfill the future 5G requirement in the microwave region. The proposed topology is a pair of folded dipoles integrated with a similar element for the lower frequency

band. In this way, an integrated element covering the frequency range of 575-960 MHz and 1.45- 2.69 GHz is obtained. In the end, a study is presented in which different ground plane shapes are tested to fulfill the radiation pattern requirement.

12:45h S2.1.3 Bocina activa plano-H en tecnología SIW

Nuria Esparza, L.F. Herrán
Dpto. de Ingeniería Eléctrica, Electrónica, de Computadores y de Sistemas.

Abstract: This paper presents an H-plane active horn antenna based on SIW technology. The antenna is implemented in SBFSS-SIW by replacing top and bottom layers with FSS working in stop band. The return losses and the radiation pattern of the antenna are compared with its SIW counterpart showing very good agreement between them. The amplifiers are fully integrated within the SIW structure thanks to SBFSS-SIW technology which allows the compatibility between biased active devices and SIW. Results show 3 to 5 dB gain improvement in the H-plane and E-plane measurements.

13:00h S2.1.4 A Planar Array Slot Antenna Fed by Top-to-Bottom-Contactless Waveguides

A. T. Muriel-Barrado, M. Sierra-Pérez, J. M. Fernández-González
Radiation Group, Signals, Systems and Radiocommunications Department, Technical University of Madrid

Abstract: A new design of planar array 6x12 slot antenna is presented. It is formed by 6 linear arrays corporately fed by conventional waveguide. The 12-slot linear arrays are fed in the middle to form two 1x6 slot arrays for bandwidth improvement. Both the top and the bottom faces of the slotted waveguides are replaced by a pair of thin substrates, where no electrical contact between waveguide walls and substrate conductors is made. Possible parallel-plate modes and coupling between waveguides are avoided by a counter-phase-fed scheme. A 2-level transition through 2 Counter-Phase Coupling Slots (CPCS) is printed in the BOTTOM substrate. The Radiating Slots (RS) are printed in the TOP substrate. Thus, fabrication process is improved since no electrical contact between layers is required, except for the Corporate Waveguide Feeding Network (CWFN) that feeds the antenna from the level below. The proposed antenna works in 34- 36 GHz band for radar applications.

13:15h S2.1.5 Antena Dual (K/Ka) de bajo perfil utilizando tecnología de guía Gap

Miguel Ferrando-Rocher, Alejandro Valero-Nogueira, Daniel Sánchez-Escuderos, José I. Herranz-Herruzo
Instituto de Telecomunicaciones y Aplicaciones Multimedia (iTEAM) Universitat Politecnica de València

Abstract: Esta comunicación propone una antena dual válida tanto para la banda K como para la banda Ka en tecnología Gap Waveguide. El desafío de esta antena es conseguir en una misma capa radiadores en dos bandas muy separadas (20 y 30 GHz). La mitad de los radiadores funcionan a 20 GHz y la otra mitad a 30 GHz. La antena es completamente metálica y los radiadores se alimentan en paralelo para mejorar el ancho de banda respecto a una alimentación serie. Los elementos radiantes se basan en ranuras excitadas mediante cavidades coaxiales. El tamaño vertical de las cavidades controla la frecuencia de trabajo. Los resultados preliminares demuestran la viabilidad de la idea con un S_{11} por debajo de -10 dB de 19.5 GHz a 21.2 GHz y de 29.5 GHz a 31 GHz y una ganancia de 21 dBi y 23 dBi en la banda RX y TX respectivamente.

13:30h S2.1.6 Elemento Radiante de Banda Ancha en Microstrip Cerrada para Arrays Alimentados en Serie

Alberto Hernández Escobar, Elena Abdo Sánchez, Carlos Camacho Peñalosa
Dpto. Ingeniería de Comunicaciones, E.T.S.I. Telecomunicación, Universidad de Málaga Andalucía Tech

Abstract: A previous radiating element in transmission con- figuration proposed by the authors is alternatively implemented using enclosed microstrip configuration. The new implementation overcomes fabrication issues and improves its compatibility with microstrip technology. Simulation and measurement of the element show a broad impedance bandwidth and a unilateral radiation pattern. To illustrate the applicability of the element, a preliminary analysis of a leaky-wave series-fed array with 7 radiating elements is carried out. Simulation results of the array show a 48 % fractional bandwidth and a single, frequency steerable beam. The beam is able to steer ±45º.

SESIÓN 2.2: Sesión especial: Canal de propagación (Parte 2)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **José Manuel Riera Salís y Luis Mendo Tomás**
Lugar: Seminario 1+2

12:15h S2.2.1 Medidas de atenuación en entorno de interiores para ondas milimétricas: montaje experimental y primeros resultados

Pedro José Sáiz Coronado, Domingo Pimienta-del-Valle, Luis Mendo Tomás, Pedro García-del-Pino, José Manuel Riera.
Information Processing and Telecommunications Center. UPM.

Abstract: The development of channel models of millimeter waves is a need to satisfy for the near future 5G wireless communication standard. For this reason, several propagation experiments have been or are being carried out with the purpose of assessing the existing propagation channel models or/and to develop new ones suitable for millimeter wave. In this paper the initial phase of indoor millimeter wave experimental measurements in the Universidad Politécnica de Madrid (UPM) by the GTIC-Radiocommunication Research Group is presented. In addition, the main equipment setup, the data processing and the first experimental results are described. Measurements were gathered in a hallway for line-of-sight (LOS) conditions at 39 GHz. With them, propagation loss has been estimated. However, more extensive measurements, in which the GTIC group is working, are desirable.

12:30h S2.2.2 Scattering Model of Wind Turbines in the Frequency Bands of Weather Radars

David de la Vega, Itziar Angulo, David Guerra, Pablo Angueira, Juan Luis Ordiales
Dpt. of Communications Engineering, University of the Basque Country (UPV/EHU)

Abstract: The World Meteorological Organization has repeatedly expressed concern over the increasing number of impact cases of wind farms on weather radars. Therefore, the assessment of the potential interference from a wind farm before it is installed is highly recommended. To do so, it is crucial to obtain a reflectivity model, based on the radar cross section (RCS) of the wind turbines. This paper

characterizes the RCS of wind turbines in the weather radar frequency bands by means of computer simulations based on the Physical Optics theory and then proposes a simplified model to estimate wind turbine RCS values. This model is of great help in the evaluation of the potential impact of a certain wind farm on the weather radar operation.

12:45h S2.2.3 Simulación del canal inalámbrico utilizando modelos geométricos extraídos a partir de nubes de puntos

Juan Pascual-García[1], José-María Molina-García-Pardo[1], María-Teresa Martínez-Inglés[2], José-Víctor Rodríguez[1], Leandro Juan-Llácer[1].
[1]Departamento Tecnologías de la Información y las Comunicaciones, Universidad Politécnica de Cartagena,
[2]Centro de Defensa, San Javier, Ministerio de Defensa-Universidad Politécnica de Cartagena

Abstract: In recent years, point clouds obtained from laser scanning devices have been used in the simulation of the wireless channel; these point clouds represent with high accuracy the environment leading to an improvement in the channel prediction. However, the estimation of specular replicas using point clouds is a difficult task. In this work, flat rectangular surfaces of the environment elements are extracted from a point cloud producing a complete geometrical model. This model is used in a ray tracing tool that easily estimates the specular components, whereas diffuse components are estimated using points sampled from the geometrical model.

13:00h S2.2.4 UWB Propagation for Medical In-Body Devices

Concepción García-Pardo[1], Carlos Andreu Estellés[1], Sofía Pérez Simbor[1], Sergio Castelló Palacios[1,2], Alejandro Fornes-Leal[1], Martina Barbi[1], Ana Vallés-Lluch[2,3], Narcis Cardona[1]
[1]Instituto de Telecomunicaciones y Aplicaciones Multimedia (iTEAM). Universitat Politècnica de València.
[2]Centro de Biomateriales e Ingeniería Tisular (CBIT). Universitat Politècnica de València.
[3]CIBER-BBN

Abstract: The use of wireless communications in medical devices is expected to improve the quality of life of patients as well as the early diagnosis of different kinds of diseases. Future wireless medical sensors will be deployed inside the human body, collecting and monitoring different kinds of parameters. Thus, a proper wireless link is necessary in addition to enough bandwidth and data rate. Recently, UWB has emerged as a potential candidate to fulfill these requirements. However, the transmission of wireless signals through the human body is challenging due to the high losses of the different body tissues, especially at UWB frequencies where such losses are frequency dependent. Therefore, an accurate characterization of the radio channel is mandatory to adequately design and test new medical devices. In this paper, an overview about UWB radio channel characterization is addressed. Modeling considering software simulations, laboratory measurements using phantoms, and in vivo experiments is considered.

13:15h S2.2.5 Wireless Channel Characterization of Context Aware Environments and Applications

Leyre Azpilicueta[1], Fran Casino[2], Peio Lopez-Iturri[3], Erik Aguirre[3], Mikel Celaya-Echarri[1], Agusti Solanas[2], Francisco Falcone[3,4]
[1]Tecnológico de Monterrey, Monterrey, México

[2]Universitat Rovira i Virgili
[3]Dpto. de Ing. Eléctrica y Electrónica. Universidad Pública de Navarra
[4]Institute for Smart Cities. Universidad Pública de Navarra

Abstract: In order to implement context aware scenarios, seamless interactivity is a necessary requirement, achieved mainly through the use of multiple wireless communication systems. The increase in the number and density of transceivers as well as limiting conditions such as reduced form factors and user presence require system analysis as well as wireless channel characterization in order to adequately account for overall interference and hence, coverage/capacity relations. In this work, deterministic based techniques adapted to these new context aware scenarios are presented, in order to provide insight in system planning and deployment phases.

13:30h S2.2.6 Experimento con Alphasat en Madrid: Resultados y modelado de la probabilidad de ocurrencia de los desvanecimientos.

Domingo Pimienta del Valle[1], José M. Riera[1], Pedro García-del-Pino[1], Gustavo A. Siles[2]
[1]Information Processing and Telecommunications Center (IPTC), Universidad Politécnica de Madrid (UPM)
[2]Universidad Privada Boliviana (UPB), Cochabamba, Bolivia

Abstract: The fade dynamic is used in order to characterize the satellite propagation channel conditions. Two parameters (among others) allow the assessment of the fade dynamics: the fade and the inter-fade durations. When testing fade duration models they do not behave as good as it is desirable. In the case of inter-fade duration, there is not an accepted model to describe its statistical behavior. Furthermore, modeling efforts at Q-band are scarce. These are the reasons to conduct a fade and inter-fade duration modeling effort using a 3-year period of measurements from the Q-band Alphasat experiment in Madrid. To achieve that, several function combinations were tested to describe the probability of occurrence either for fade or inter-fade durations. Results show that a two log-normal combination allows describing properly both parameters, but some modifications must be made in the fade-duration case. Also, a three log-normal distribution may be used if it is required the description of inter-fade durations longer than one million seconds.

SESIÓN 2.3: Sistemas de Comunicación

Presidentes de sesión: **Juan Valenzuela Valdés y Javier Carmona Murillo**
MIÉRCOLES, 12:15-14:00
Lugar: Seminario 3+4

12:15h S2.3.1: Análisis comparativo de las tecnologías de capa física propuestas en el estándar IEEE P1901-2010

Fausto García G., Freddy A. Pinto Benel y Fernando Cruz Roldan
Dpto. de Teoría de la Señal y Comunicaciones. Universidad de Alcalá

Abstract: El estándar IEEE P1901-2010 especifica los dos primeros niveles del modelo OSI (nivel FÍSICO y nivel de Control de Acceso al Medio (MAC)) de un sistema de comunicaciones de banda ancha a través de la red eléctrica (Power Line Communications (PLC)). Para el primer nivel propone un sistema

multiportadora OFDM con dos realizaciones alternativas: FFT OFDM (epígrafe 13) o Wavelet OFDM (epígrafe 14). El presente artículo es el resultado de un análisis comparativo sobre el rendimiento de ambas, medido este en términos de la tasa de error de bit (BER).

12:30h S2.3.2 Análisis del canal de comunicación inalámbrico y su impacto en los mecanismos de gestión de la movilidad

Javier Carmona Murillo[1], Juan Francisco Valenzuela Valdés[2], Pablo Padilla[2], Juan Carlos González Macías[1], Francisco Javier Rodríguez Pérez[1], Francisco Luna Valero[3]
[1]Departamento de Ingeniería de Sistemas Informáticos y Telemáticos, Universidad de Extremadura
[2]Departamento de Teoría de Señal, Telemática y Comunicaciones – CITIC, Universidad de Granada
[3]Departamento de Lenguajes y Ciencias de la Computación, Universidad de Málaga

Abstract: In the last years, the commercial deployment of data services in mobile networks has been evolving quickly, providing enhanced radio access technologies and more efficient network architectures. Even so, the requirements of the future 5G networks, as well as the traffic growth foreseen for the future years make necessary the design of efficient communications mechanisms. Among the key factors that will enable the next generation networks, it is worth pointing out both the wireless channel and the IP mobility management. Although traditionally these two research lines have been developed almost separately, in this article we analyse the impact of the wireless communication channel on the performance of mobility management protocols. Obtained results show the benefits of consider jointly both in order to reduce the signalling overhead generated by layer three protocols.

12:45h S2.3.3 Erasable/Programmable Chipless-RFID Tags with Orientation-Independent Sequential Bit Reading

Cristian Herrojo[1], Miquel Moras[2], Ferrán Paredes[1], Javier Mata-Contreras[1], Alba Núñez[2], Eloi Ramon[2] and Ferrán Martín[1]
[1]CIMITEC, Departament d'Enginyeria Electrònica, Universitat Autònoma de Barcelona
[2]Institut de Microelectrònica de Barcelona, IMB-CNM (CSIC)

Abstract: This paper presents erasable/programmable chipless radiofrequency identification (chipless-RFID) tags that can be read by proximity (through near-field coupling to the reader) and sequentially in time domain. The tags consist of a linear chain of identical resonant elements printed at predefined and equidistant positions on a dielectric substrate, and each resonant element provides a bit of information. The tags can be programmed by cutting (detuning) those resonators with bit set to the '0' logic state, whereas tags can be erased (all bits set to '1') by simply short-circuiting those resonant elements previously detuned, thus recovering their functionality. The reader is a transmission line loaded with a resonant element identical to those of the tag chain and fed by a harmonic signal (interrogation signal). Such signal must be tuned to a frequency in the vicinity of the fundamental resonance frequency of the resonant elements, and tag reading proceeds by displacing the tag chain over the line axis, in close proximity to it, through a guiding system. The main relevant aspect of the proposed tags is the fact that by adding a pair of header bits (resonators), with different code, at both sides of the tag chain, it is possible to read the tags regardless of their relative orientation to the reader. Namely, it is demonstrated that tag reading is either possible by displacing the tag over the reader with the resonator chain printed on the top or the bottom face of the tag substrate. This is an important practical aspect for the potential use of this chipless-RFID system in secure paper applications, since the user does not need to know how to

introduce the tag in the guiding system (i.e., face-up or face-down). System validation is reported by considering tags implemented in low-loss commercial microwave substrates, and also printed on ordinary (low-cost) din A4 paper.

13:00h S2.3.4 Estudio de la influencia de la correlación y el desbalanceo de potencia en Sistemas MIMO Distribuidos.

J.C. Gonzalez-Macías[1], Antonio Valenzuela-Valdés[2], J.F Valenzuela-Valdés[2], Javier Carmona Murillo[1], P. Padilla[2]
[1]Departamento de Ingeniería de Sistemas Informáticos y Telemáticos, Universidad de Extremadura
[2]Departamento de Teoría de Señal, Telemática y Comunicaciones – CITIC, Universidad de Granada

Abstract: In this paper, it has been studied the behavior of distributed or cooperative Multiple Input Multiple Output (MIMO) systems working with different number of base stations and antennas. This contribution examines Distrubuted MIMO for frequencies above 6 GHz. The propagation channel has been simulated with NYUSIM simulator. It has been obtained the propagation parameters for the three environments: RMa (rural macrocell), UMa (urban macrocell) and UMi (urban microcell). Different frequencies (10, 28 and 40 GHz) and different conditions (LOS and NLOS) are tested. From the channel parameters it is calculated different MIMO parameters. The transmitting stations have been simulated with 25 antennas and the receiver has 10 antennas. The results show the different behavior in the different scenarios.

13:15h S2.3.5 Optimización del rango de operación en aplicaciones de Interferometría RF

RF J. Benítez y J. Mora
Photonics Research Labs, ITEAM Research Institute, Camino de Vera, s/n – Universitat Politècnica de València

Abstract: This work proposes a novel structure combining low coherence interferometry (LCI) and microwave photonics (MWP). The novelty of the structure is based on the strategical placement of the electro-optic modulator (EOM) inside the interferometric structure. With this, it is possible to overcome some typical limitations related to previous MWP-LCI contributions, such as the DC term, the self-reflection term and the carrier suppression effect (CSE). Avoiding these limitations permits to improve the operation range when comparing with previous proposals. Moreover, a detailed theoretical description of the MWP-LCI structure proposed in this work is addressed to support the experimental demonstration. Finally, typical LCI capabilities such as penetration depth, resolution and sensitivity are measured. In this case, a 1 cm penetration depth with a resolution of 120 μm and a sensitivity beyond 50 dB are achieved.

13:30h S2.3.6 Desfasador electrónicamente reconfigurable en banda Ku optimizado con algoritmos genéticos

Mohamed Taha ElKhorassani[1], Miguel Ángel Vaquero[1], Ángel Palomares[1], Juan F. Valenzuela-Valdés[1], Pablo Padilla[1] y Naima Amar Touhami[2]
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[2]Department of Physics, University Abdelmallek Essaadi, Morocco

Abstract: We present the design of a microwave phase shifter at Ku band for active steerable array devices, with enhancement in both its phase range and its power transmission. The device is based on a

hybrid coupler with two of its ports loaded with reflective circuits. The reflective circuit provides the tunable nature to the device by means of electrically tunable varactors. This circuit includes impedance transformation whose design is realized by a genetic algorithm optimization process. The document includes the design of the shifter components, mainly focused on the reflective circuit design, and a complete shifter design.

SESIÓN 2.4: Sesión especial: Componentes pasivos para aplicaciones espaciales (Parte 2)

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Ángel San Blas Oltra y Ángela Coves Soler**
Lugar: Seminario 6

12:15h S2.4.1 Diseño sistemático de filtros comb-line en línea implementados en tecnología guiada.

A. A. San Blas[1], P. González[2], V. E. Boria[2] , P. Soto[2] , M. Guglielmi[2]
[1]Departamento de Ingeniería de Comunicaciones. Universidad Miguel Hernández de Elche.
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Abstract: In this work, a systematic procedure for the efficient design of in-line comb-line filters implemented in waveguide technology is presented. The proposed method is based on a stepby-step strategy, in such a way that the different resonators of the filter are progressively added one just after each other. Moreover, the electrical response of an equivalent circuit model based on ideal inverters and lumped elements (series L-C resonant circuit) is used as a reference curve in each of the steps of the design process. In order to validate the proposed technique, a 4-pole band-pass filter has been successfully designed.

12:30h S2.4.2 Estudio de Distintas Técnicas de Ajuste de Campo para Analizar Dispositivos en Guía de Onda de Comunicaciones por Satélite.

Juan Córcoles Ortega[1], Raúl V. Haro Baez[1], José R. Montejo Garai[2], Ana Morán López[1], Lucas Polo López[1], Jesús M. Rebollar[2], Jorge A. Ruiz Cruz[1]
[1]Escuela Politécnica Superior, Universidad Autónoma de Madrid.
[2]Escuela Técnica Superior de Ingenieros de Telecomunicación, Universidad Politécnica de Madrid.

Abstract: Analysis and design of passive waveguide devices has significantly evolved in the last years. Although nowadays there are available powerful software packages based on general numerical techniques, this paper is focused on those problems where quasi-analytical methods, reviewed in this contribution, are still the key for a successful design. In high-performance waveguide components for satellite systems, modelling must be very precise, and, at the same time, fast enough for computed aided design driven by optimization. For this type of problems in waveguide technology, methods based on modal series and field matching are very efficient. This paper addresses the advantages and drawbacks of some of these field-matching techniques in the context of satellite communication designs, especially in problems involving dual-polarization with ortho-mode transducers, field rotators and polarizers.

12:45h S2.4.3 Filtro Pasobanda con Alto Factor de Calidad en Línea Coaxial Integrada en Sustrato Vacío (ESICL) para Aplicaciones Espaciales.

Leticia Martínez[1], Alejandro L. Borja[1], Héctor Esteban[2], Vicente E. Boria[2], Ángel Belenguer[1]
[1]Instituto de Tecnología, Construcción y Telecomunicaciones. Universidad de Castilla - La Mancha.
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universitat Politècnica de València.

Abstract: This paper presents the design and performance of a bandpass filter in Empty Substrate Integrated Coaxial Line (ESICL) technology. ESICL is a novel transmission line that has recently appeared, attending to the current needs to improve the performance of planar circuits at high frequencies. A fifth-order bandpass Chebyshev filter with 2.3 % fractional bandwidth and 0.01 dB ripple at 13 GHz has been designed. This is the ESICL bandpass filter with the lowest bandwidth designed to date. A prototype has been manufactured to verify its correct operation in Ku-band, usually employed for satellite communications. The experimetnal results obtained through measurements of the fabricated prototype are very similar to the simulated data.

13:00h S2.4.4 Receptor criogénico en banda Ka para aplicaciones de espacio profundo.

A. Mediavilla[1], J.L. Cano[1], D. Vegas[1], E. Artal[1], A. Tazón[1], L. M. de la Fuente[1], C. Chambón[2], B. Fauroux[2], R. Rayet[2], S. Rawson[2], S. Halté[3]
[1]Dpto. de Ing. de Comunicaciones. Universidad de Cantabria.
[2]Callisto France, Villefranche du Lauragais, Francia.
[3]ESA-ESOC. Darmstadt. Alemania.

Abstract: This paper describes the design of a ground station antenna feed system, that includes feed horn, polarizer, rejection filter, mono-pulse tracking coupler and low noise amplifiers with polarisation switching. The entire feed system assembly is cooled to cryogenic temperature (T < 10 K) in order to maximise the G/T of the ground station antenna. The cryogenic cooling system described is fully redundant and this novel design allows one cryocooler to be removed and replaced, while the other cryocooler is still running. The design has been submitted for patent protection.

13:15h S2.4.5 Técnica de diseño de corrección en frecuencia para filtros de cavidades arbitrarias 3D.

Alejandro Pons Abenza[1], Alejandro Álvarez Melcón[1], Fernando Quesada Pereira[1], Lara Arche Andradas[2]
[1]Dpto. de Tecnologías de la Información y las Comunicaciones, Universidad Politécnica de Cartagena.
[2]Thales Alenia Space España.

Abstract: In this work, a refinement of the classical coupled cavity filter design technique is presented. This refinement consists of a central frequency correction when calculating interresonator cavity couplings. The correction introduced is specially critical when 3D shapings are applied to empty cavities, since both resonators and couplings become more dispersive, and frequency tuning is harder due to an increased sensitivity with the resonator geometry. To validate the design approach, a filter design with shaped cavities is realised, where it can be seen that the traditional design technique leads to a starting point which is significantly far from the target specifications. However, the use of the new technique increases the accuracy of its initial response, allowing a simpler final optimization process. The technique

presented can have big impact in the efficient design of future filter structures, where 3D shapings are applied to improve performances.

13:30h S2.4.6 Validación de la Tecnología Empty Substrate Integrated Waveguide en Banda Q.

Juan A. Martínez[1], Ángel Belenguer[1], Héctor Esteban[2], y Vicente E. Boria[2]
[1]Instituto de Tecnología, Construcción y Telecomunicaciones, Universidad de Castilla-La Mancha.
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia, Universitat Politècnica de València.

Abstract: In the last years, the research of communication waveguides in Substrate Integrated Circuits (SIC) has been further developed. Empty Substrate Integrated Waveguide is one of them, which has the advantages of both the classical waveguides (low losses and high quality factor), and of integrated solutions (low fabrication cost, low weight and profile, and easy integration in planar devices). Since fields propagate through air in ESIW circuits, they achieve better performance than other SICs. It is interesting to evaluate the performance of this novel topology at high frequencies. In this paper, it is presented, for the first time, an ESIW filter operating in Q band. Some important manufacturing details, that have to be taken into account to obtain high-quality prototypes, are also discussed. The shape of the laser cut employed to manufacture the filter has been analyzed, and an appropriate correction has been proposed. In order to evaluate the roughness of metals, the filter has been manufactured using covers implemented with different substrates.

SESIÓN 2.5: Fotónica y Comunicaciones Ópticas

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Pedro Chamorro Posada y Miguel del Castillo Vázquez**
Lugar: Sala Andalucía II

12:15h S2.5.1 Amplificador óptico de fibra dopada con Er/Yb y múltiples cubiertas para redes ópticas de distribución de CATV

Borja Fernández[1], Álvaro Albero[1], Beatriz Ortega[1], Rafael de Uña[2]
[1]Instituto de Telecomunicaciones y Aplicaciones Multimedia, ITEAM, Universitat Politècnica de València
[2]Televés, S.A., Santiago de Compostela

Abstract: In this paper we demonstrate the experimental implementation of an EYDFA based on multiple cladding fiber. High gain of 35.09 dB, 35.15 dBm output power and a noise figure of 6dB have been measured under saturation conditions, and therefore, the requirements for optical CATV distribution networks are fully satisfied.

12:30h S2.5.2 Análisis de la probabilidad de error en sistemas de comunicaciones ópticas subacuáticas afectadas por turbulencia inducida por salinidad

Nuria González Serrato, Antonio Jurado-Navas, José María Garrido-Balsells, Miguel del Castillo-Vázquez, Antonio Puerta-Notario
Dpto. de Ingeniería de Comunicaciones, Universidad de Málaga

Abstract: Underwater Wireless Optical Communication (UWOC) systems are presented as a reliable alternative to typical underwater wireless systems (radio-frequency (RF) and acoustic waves). In comparison to RF and acoustic counterparts, UWOC can provide a much higher transmission bandwidth and much higher data rate. Recently, a variety of potential applications for UWOC systems have been proposed including environmental monitoring, offshore exploration, disaster precaution, and military operations. Although underwater channels are unpredictable due to scattering and turbulence processes associated to salinity, temperature, bubbles and turbidity, however, recently, a Weibull distribution has been demonstrated to have an excellent agreement to characterize the fading of salinity induced oceanic turbulence. Furthermore, an approximate closed-form expression is derived in this paper for the average bit error rate by means of a Gauss-Laguerre quadrature. Numerical results obtained via Monte-Carlo simulation are provided to corroborate the validity of the analytical expression.

12:45h S2.5.3 Comparación de las técnicas OFDM y multi-CAP para comunicaciones ópticas MIMO en el visible

Oswaldo González[1], Khald Werfli[2], Navid B. Hassan[2], Andrew Burton[2], Zabih Ghassemlooy[2], Hoa Le Minh[2]
[1]Dpto. de Ingeniería Industrial, Universidad de La Laguna
[2]Faculty of Engineering and Environment, Northumbria University, Newcastle upon Tyne NE1 8ST, United Kingdom

Abstract: In this paper, we compare orthogonal frequency division multiplexing (OFDM) with multi-band carrier-less amplitude and phase modulation (m-CAP) in a multiple-input multiple-output (MIMO) scenario as two promising bandwidth efficient techniques for visible light communication (VLC) systems. Both schemes are experimentally demonstrated for a rate-adaptive 4 × 4 MIMO system (four light-emitting diodes and four optical receivers; optical link over 1 meter), thus providing multi-user transmission in a VLC environment with data rates beyond 100 Mbit/s (aggregate throughput) while operating under the forward error correction bit error rate limit of $3.8 \cdot 10^{-3}$. The m-CAP system enhances OFDM performance while presenting a similar implementation complexity making it a promising candidate to be considered in the development of future VLC infrastructures.

13:00h S2.5.4 Wavelength demultiplexor inscribed in optical fiber end-face by femtosecond laser

D. Pallarés-Aldeiturriaga[1], L. Rodríguez-Cobo[2], M. Lomer[1,2,3] and J.M. López-Higuera[1,2,3]
[1]Photonics Engineering Group, University of Cantabria
[2]CIBER-bbn, Instituto de Salud Carlos III, Madrid
[3]Instituto de Investigación Sanitaria Valdecilla (IDIVAL), Cantabria

Abstract: In this work, a tilted diffraction grating has been inscribed by a femtosecond laser in the bulk of a multi mode fiber for light demultiplexion. Using a longitudinal inscription setup, diffraction grating has been inscribed 60μm below surface, allowing tilted inscription and being more resistant to damage than a surface gratings. Tilt is an effective way to filter orders, as diffraction efficiency can drop depending on tilt angle. Beam propagation method (BPM) has been used to estimate necessary tilt angle to filter all order except ”0” and ”-1”. The fiber was illuminated by red and blue light, showing good spatial agreement in ”-1” order.

13:15h S2.5.5 Dispositivos basados en guías curvas acopladas asimétricas para integración fotónica en nitruro de silicio

Pedro Chamorro-Posada
Dpto. de Teoría de la Señal y Comunicaciones e Ingeniería Telemática, Universidad de Valladolid, ETSI Telecomunicación

Abstract: Radiation losses in curved coupled asymmetric waveguides can be reduced or augmented in relation with those of a single curved waveguides. This effect leads to interesting applications for optical integrated circuits, particularly in those photonic integration platforms where the refractive index contrast makes radiation loss at bent waveguides a relevant issue, such is the case of silicon nitride. Two specific applications are analysed in detail: the implementation of ultracompact integrated polarizers and the realization of integrated micro-resonators with enhanced intrinsic Q factor. Results of experiments in progress will be presented at the time of the conference.

13:30h S2.5.6 Parametrización física de canales ópticos turbulentos modelados con la distribución M

José M. Garrido Balsells, Antonio Puerta Notario, Antonio Jurado Navas, Miguel del Castillo Vázquez
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: In this contribution, the analysis of the scintillation index and its relationship to physical parameters of the turbulence in a free-space optical channel is performed, assuming that the scintillation induced by the atmospheric turbulence is modeled by the Málaga or M statistical distribution. The novelty in this study is the stablishment of direct analytical expressions for the statistical parameters of the received random optical irradiance to those that define the atmospheric turbulence behavior, by means of the decomposition of the optical channel in a finite number of Generalized-K sub-channels and their similitude to Gamma-Gamma distribution presented in the bibliography. In this sense, closed-form mathematical expressions for the calculation of the scintillation index under M distributed channel are provided for each of such individual sub-channels as well as for the global atmospheric effect, what leads to a simple procedure to predict the link behavior under any turbulence condition.

13:45h S2.5.7 Simulador de dispositivos SLM basados en cristal líquido

Nicolás J. Gallego Molina, Antonio Puerta Notario, Miguel del Castillo Vázquez, José M. Garrido Balsells
Dpto de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: In this work, a spatial phase modulation simulator for use in free space optical communications is presented. The simulator is based on TNLCD (Twisted Nematic Liquid Crystal Display) devices. First, the characteristics and properties of liquid crystals as birefringent uniaxial media are examined. Subsequently, by means of a simple analytical model, the different optical elements of a spatial light modulator (SLM) are characterized in terms of the corresponding Jones matrices. The expressions derived from this characterization are, then, introduced in the simulation tool to obtain the spatial phase difference and the transmittance produced by the SLM. Finally, the performance of the SLM simulator has been verified by comparing theoretical and simulation results for different test excitations.

SESIÓN 2.6: Sesión especial: Sensores y sistemas inalámbricos

MIÉRCOLES, 12:15-14:00
Presidentes de sesión: **Sandra Sendra Compte y Lorena Parra Boronat**
Lugar: Sala Andalucía III

12:15h S2.6.1 Comparativa de técnicas de estimación de la velocidad puntual de vehículos usando sensores inductivos de doble bucle.

José J. Lamas-Seco, Paula M. Castro, Francisco J. Vázquez-Araujo, Francisco Laport, Adriana Dapena
Dpto. de Ingeniería de Computadores. Universidade da Coruña Facultade de Informática

Abstract: The measurement of the vehicle spot speed is a fundamental task in intelligent transportation systems and it has been deeply studied in recent years. In this article we make a comparison of performance between the most used mean-based techniques for spot speed estimation using double-loop inductive sensors. The estimation errors obtained from simulation demonstrate the validity of these methods for its use in systems where the measurement of travel time between two spaced sensors is available. Moreover, the method based on the harmonic mean shows better performances when it is compared to the traditional one based on the arithmetic mean, even in presence of vehicle constant acceleration.

12:30h S2.6.2 Impact of Clock Frequency on the Performance and Consumption of a Secure IoT Node

Manuel Suárez-Albela, Tiago M. Fernández-Caramés, Paula Fraga-Lamas, Luis Castedo
Dpt. Computer Engineering, Faculty of Computer Science, Universidade da Coruña

Abstract: Securing IoT sensor networks communications is a critical aspect for granting the viability and adoption of IoT sensor network deployments. The use of security mechanisms by resource-constrained IoT sensor nodes has a great impact in the energy efficiency, throughput and scalability of the whole sensor network. Two of the key considerations for optimizing both energy efficiency and performance are the selection of a proper set of algorithms and the configuration of the hardware parameters of an IoT node according to its specific use. The aim of this work is to analyze how modifying the operating frequency of an IoT sensor node affects these metrics. A publickey authenticated encryption algorithm was chosen to perform the tests presented in this paper, since it provides the key properties (i.e., confidentiality, integrity and authenticity) needed in an IoT sensor network. The selected algorithm uses x25519 as key exchange algorithm, XSalsa20 as ciphering algorithm and Poly1305 as MAC algorithm. An execution time and energy consumption analysis was performed for each of the algorithm phases using an ESP32 and running the System-on-Chip (SoC) at 80, 160 and 240 MHz. The obtained results show that, by increasing the clock frequency, the time required for executing each of the algorithms is reduced, resulting in a higher throughput. Moreover, due to this reduction in processing time, the total energy consumption is also greatly reduced when using higher frequencies.

12:45h S2.6.3 Performance of LoRaWAN on a Highway Scenario

Pablo Romero Díaz[1,2], Jorge Navarro Ortiz[1,2], Sandra Sendra[1,2,3], Juan J. Ramos Muñoz[1,2]
[1]Dept. of Signal Theory, Telematics and Communications. University of Granada.

[2]Research Centre for Information and Communications Technologies of the University of Granada
[3]Instituto de Investigacin para la Gestin Integrada de zonas Costeras Universitat Politecnica de Valencia

Abstract: The current growing interest in Internet of Things (IoT) has facilitated the appearance of Low-Power Wide Area Networks (LPWAN). Networks based on the LoRaWAN (Long Range Wide Area Network) standard stand out among these. The aim of this article is to describe in detail these networks and to make an initial assessment of the performance in highway scenarios. In order to do this perfomance evaluation, a LoRaWAN network prototype has been created.

13:00h S2.6.4 An IoT System for Monitoring Indoor Radon Gas Exposure.

Óscar Blanco-Novoa, Tiago M. Fernández-Caramés, Paula Fraga-Lamas, Luis Castedo
Dpt Computer Engineering, Faculty of Computer Science, Universidade da Coruña

Abstract: Radon is a noble gas that emanates naturally from the soil and from some building materials where traces of uranium or thorium are found. Humans have problems detecting radon gas without proper tools since it is invisible, odorless, tasteless and colorless. The main issue is that epidemiological studies have linked high concentrations of radon and the incidence of lung cancer. In fact, the United States Environmental Protection Agency has stated that the presence of radon is the second most common cause of lung cancer for smokers and the number one among non-smokers. Today, there are commercial radon detectors, but they are usually either quite limited in functionality or too expensive for the average householder. This article presents an IoT hardware and software platform that augments the capabilities of a commercial low-cost sensor for remote monitoring indoor radon gas concentration. The system is able to collect accurate concentration measurements that can be displayed on a web-based interface that can be accessed through the Internet by using desktop or mobile devices. It can also trigger events to prevent dangerous situations and to warn the users about the level of exposure. Furthermore, its modular design enables the easy addition of other sensors and actuators.

13:15h S2.6.5 Fosforímetro modular de bajo coste para la determinación *in situ* de oxígeno gaseoso.

Santiago Medina Rodríguez[1], Carlos Medina Rodríguez[1], Ángel de la Torre Vega[2], José C. Segura Luna[2], Jorge F. Fernández Sánchez[3]
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[3]Dpto. de Química Analítica. Universidad de Granada. Facultad de Ciencias

Abstract: In this work we present the architecture of a modular, portable and low-cost phosphorescence instrument for accurate determination of gaseous oxygen. This instrument implements a novel multifrequency phase-modulation method for luminescence spectroscopy based on a rectangular-wave modulated excitation source with a short duty cycle. From the Fast Fourier Transform (FFT) of the excitation and emission rectangular wave signals, phase-shift- and modulation-factor-based apparent lifetimes are estimated at each harmonic independently (together with their corresponding standard errors) and optimally combined to improve the accuracy in the determination of oxygen. The accuracy of the phosphorescence instrument has been evaluated using a gas station. The experimental results show

an excellent measurement accuracy with a similar performance to the most modern phosphorescence instruments.

13:30h S2.6.6 Smart Irrigation Tube: a Wireless System for Water Detection in Precision Agriculture.

Lorena Parra[1], Javier Rocher[1], Sandra Sendra[1,2], Jaime Lloret[1]
[1]Instituto de Investigación para la Gestión Integrada de zonas Costeras. Universitat Politècnica de València
[2]Dep. de teoría de la señal, telemática y comunicaciones, ETS Ingenierías Informática y de Telecomunicación. Universidad de Granada

Abstract: The tubes are the best option for transporting the water in tree fields. However, due to the large size of the tubes networks and the fact that they are under the ground, their control is usually very difficult. In precision agriculture the tubes are used for irrigation. For this reason, the use of wireless sensor networks (WSNs) is a good option for monitoring the water network. In this paper we present a system for monitoring the soil humidity content and the tubes conditions. The presented system is able to monitor the tubes state and humidity content in the ground. This system is based on a commercial humidity sensor and a new sensor for tubes monitoring. The tube sensor is composed by two coils. A coil is powered by an alternate current which induces a current, as a function of the medium, in the other coil. Our results show that this sensor is able to differentiate between an empty pipe and a pipe filled with water. Any abnormal situation is detected and the system sends an alarm. As a result of our proposal we obtain a Smart Irrigation Tube able to monitor the irrigation needs of an area and to detect any obstruction or breakage in the tubes.

SESIÓN 3.1: Sesión especial: Técnicas y sistemas de medida de antenas

VIERNES, 15:30-17:15
Presidentes de sesión: **Fernando Las Heras Andrés y Manuel Sierra Castañer**
Lugar: Sala Andalucía I

15:30h S3.1.1 Advances in Reverberation Chamber antenna testing

Miguel Á. García-Fernández[1], David A. Sánchez-Hernández[2]
[1]EMITE Ingeniería S.L. R&D Department. Edif. ELDI. Cartagena.
[2]GIMRE Research Group. Universidad Politécnica de Cartagena

Abstract: As new applications and technologies become the target of antenna designers, there is an ever-increasing demand on adding smart capabilities to the antenna-RF-front-end of devices, particularly in mobile wireless communication systems. The use of MIMO antennas has prompted the need to define new antenna parameters which better resemble the performance in the field, like MIMO Capacity or Diversity Gain. This contribution summarizes some advances in testing of antennas for wireless mobile communications using reverberation chambers, which add fading to the conventional antenna testing and complexity to the figures of merit under evaluation.

15:45h S3.1.2 In-situ Antenna Diagnostics and Characterization by means of Unmanned Aerial Vehicles

Yuri Álvarez López[1], María García Fernández[1], Ana Arboleya Arboleya[2], Borja González Valdés[3], Yolanda Rodríguez Vaqueiro[3], Fernando Las-Heras Andrés[1]
[1]Área de Teoría de la Señal y Comunicaciones. Departamento de Ingeniería Eléctrica. Universidad de Oviedo
[2]Departamento de Teoría de la Señal y las Comunicaciones. Universidad Rey Juan Carlos
[3]Departamento de Teoria do Sinal e Comunicacions. Universidad de Vigo

Abstract: A low-cost, compact, Unmanned Aerial System for Antenna Measurement (UASAM) is presented. The developed system overcomes existing limitations in terms of Unmanned Aerial Vehicle (UAV) cm-level navigation and geo-referred data acquisition by means of Real Time Kinematic (RTK) and laser altimeter. Field radiated by the Antenna Under Test (AUT) is measured with a low-cost power sensor at several acquisition surfaces (even non-canonical surfaces) around the AUT. Next, an iterative phase retrieval technique is applied to the AUT measurements, recovering the AUT aperture fields, which provide valuable information for antenna diagnostics (e.g. detection of malfunctioning elements). Furthermore, from the aperture fields, Near-Field to Far-Field (NF-FF) transformation can be applied to calculate the AUT radiation pattern. The proposed system is of interest for rapid assessment of the operational conditions of the antennas, allowing detection of distorted radiation patterns (in terms of directivity, tilt, front to back ratio) and even identification of the causes of such distortion (malfunctioning elements both in the radiation elements of the antenna or in its beamforming/feeding network).

16:00h S3.1.3 Iterative Method for Near Field to Far Field Transformation over Arbitrary Measurement Surfaces

Fernando Rodríguez Varela, Manuel Sierra Castañer, Belén Galocha Iragüen
Dpto. de Señales, Sistemas y Radiocomunicaciones, Universidad Politécnica de Madrid.

Abstract: Classical near field to far field transformation algorithms are unable to deal with irregularly distributed measurement samples. As frequency increases, this may be a serious limitation in certain scenarios. In this paper a near field to far field transformation algorithm that works with samples over arbitrary measurement surfaces is investigated. The approach is based on the modeling of the measured fields using a spherical wave expansion. The spherical modes are obtained solving a linear system of equations using an iterative method. The algorithm is validated using analytical antenna models, showing controllable transformation errors. To reduce the computation time of the iterative solver, a matrix preconditioner implemented by means of a fast operator is presented.

16:15h S3.1.4 Evaluation of Software Defined Radio Receiver for Phaseless Near-Field Measurements

Rubén T. Sánchez[1], Manuel Sierra Castañer[1], L.J. Foged[2]
[1]Centro de Investigación en Procesado de la Información y Telecomunicaciones, ETSI Telecomunicación. Universidad Politécnica de Madrid
[2]SATIMO, Pomezia, Italy.

Abstract: This paper presents a time domain antenna measurement technique by using a low cost software defined radio (SDR). The amplitude and phase measurement performance of the SDR is

evaluated for single frequency as well as pulsed signals. In the new scenarios, e.g. 5G, the antenna is integrated with the system and the measurement of the phase and amplitude of the antenna at the feed point is not possible. Hence, phase reconstruction techniques are required to obtain the radiation pattern or to reconstruct the sources on the antenna. The paper aims to characterize the feasibility and uncertainty of the amplitude and phase retrieval for tone and pulsed measurements. The technique is based on calculating the Fast Fourier Transform (FFT) of the time domain signal to estimate the power spectrum and relative phase of the input signals. The results demonstrate the potential of this technique for new antenna measurement systems.

16:30h S3.1.5 INTA facilities and methods for electromagnetic characterization of aerospace composite materials

Borja Plaza Gallardo[1], Patricia Gómez de Francisco[2], David Escot Bocanegra[2], David Poyatos Martínez[2]
[1]ISDEFE as external consultant for INTA, Madrid
[2]Radiofrequency Area, National Institute for Aerospace Technology (INTA), Torrejón de Ardoz, Madrid

Abstract: In the last decades, the use of electromagnetic fields has been widespread in a full range of scientific and technological applications. The aeronautical platforms, both civilian and military, have not been an exception. In fact, they have used them intensively or have suffered their use, been also pioneers in many of them, like for example the use of radar systems. In parallel, the materials and covers used in these platforms are being constantly renewed for improving their performance. Therefore, it is essential to characterize their behaviour not only from the mechanical or thermal point of view, for example, but also in relation to those electromagnetic fields. In this way, the design and implementation of novel facilities and measurement methods that improve this characterization are of great utility. In this context, this paper presents two electromagnetic characterization tests carried out on composite materials. These materials have been used to manufacture the MILANO and SCRAB-II UAVs. The methods presented here are shielding effectiveness measurements for composite materials following the ASTM D4935-10 standard, and permittivity and loss tangent estimation through Metalbacked Free-Space method implemented in a bistatic anechoic chamber called BIANCHA.

SESIÓN 3.2: Aplicaciones Matemáticas: Modelado y Simulación

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Juan Córcoles Ortega y Miguel Ferrando Bataller**
Lugar: Sala Andalucía II

15:30h S3.2.1 Red Transversa Equivalente de una LWA en Tecnología SIW Funcionando con el Modo TE20.

Alejandro Javier Martínez-Ros[1], Fernando Quesada-Pereira[2] y Francisco Medina[3]
[1]Dpto. de Física Aplicada 1. Universidad de Sevilla
[2]Dpto. de Tecnologías de la Información y las Comunicaciones Universidad Politécnica de Cartagena
[3]Dpto. de Electrónica y Electromagnetismo. Universidad de Sevilla

Abstract: In this work a modal analysis tool for efficiently obtaining the complex propagation constant of a double-sided leaky-wave antenna LWA has been performed. The proposed tool is based on a transverse equivalent network TEN of the structure, which is similar to a conventional substrate integrated waveguide SIW working with its TE20 mode but with the particularity that the distance between post is large enough to allow the leakage of energy. The associated impedance of this row of metallic posts is rigorously analyze by means of an electric field integral equation EFIE based on the Green's function one dimensional periodic current filaments that has been solved by the method of moments MoM. Moreover, in order to validate this technique several practical designs at the design frequency of 15 GHz have been analyzed and compared with simulations using commercial full-wave software.

15:45h S3.2.2 Three-level parallelization of a Finite Element Code with Hybrid Meshes.

Adrián Amor-Martín[1], Daniel García-Donoro[2] and Luis Emilio García-Castillo[1]
[1]Department of Signal Theory and Communications, University Carlos III of Madrid
[2]Xidian University, Xi'an, China

Abstract: Different techniques have been applied in the last years to enhance the performance of electromagnetic simulation codes. In this communication, parallelization at three levels — at algorithmic level, using a nonconformal Domain Decomposition Method (DDM), at process level using Message Passing Interface and at thread level with OpenMP— are introduced to make a code based on Finite Element Method able to run on High Performance Computing infrastructures with versatility. Nonconformal DDM allows also to use different element shapes or families depending on the geometry of the problem to be simulated which adds flexibility on the simulation. Details of the formulation, implementation and results are presented in this paper. Results showing the computational performance of a problem comparing the introduction of each level separately are included. Results with nonconformal meshes and different element shapes are also included to show the potential and flexibility of this implementation.

16:00h S3.2.3 Método de extracción directa de modelos comportamentales a partir de medidas NVNA

M. Rocío Moure[1], Michael Casbon[2], Mónica Fernández Barciela[1], Paul J. Tasker[2]
[1]Dpto. de Teoría de la Señal y Comunicaciones
[2]School of Engineering. Universidad de Cardiff. Cardiff, Reino Unido

Abstract: Behavioral models in the frequency domain are accurate non-linear modeling CAD tools. They are usually defined in the A-B domain and indexed with |A11|, but they may also be defined in the admittance I-V domain. The main interest of behavioral admittance models relies on their ability to scale with device size and frequency, hence improving its usefulness in MMIC design. In admittance models, it is convenient to use |V11| as variable for indexing, which makes model extraction from measurements a complex procedure. In this paper, a direct extraction technique to extract behavioral models from NVNA load-pull measurements, especially suited for the admittance domain, is described and validated with GaN transistors.

16:15h S3.2.4 Solving Extremely Large Periodic Structures Through Slot FFT Techniques.

A. Serna[1], L. Landesa[1], M. F. Manzano[2], J. M. Taboada[1]

[1]Department of Computer and Communication Technology. University of Extremadura. Escuela Politécnica
[2]ADASA Sistemas

Abstract: Periodic materials are widespread in many modern optical and RF applications. Despite this, the electromagnetic analysis of this kind of structure is still bound to the need of not so-accessible HPC resources due to the memory and computing times needed when rigorous analysis is required though full-wave methods like method of moments (MoM). By the application of signal theory concepts to the impedance matrix posed with MoM the cost of the solution through iterative methods like GMRES can be reduced from $O(N^2)$ to an equivalent $O(N \log(N))$.

16:30h S3.2.5 Análisis en frecuencia de lente de Fresnel en microondas mediante simulación full-wave

Patricio Gross[1,3], Julieta Vernieri[1], Felipe Vico[2], J. Alberto Bava[1,4], Miguel Ferrando Bataller[2,4]
[1]Dpto. de Electrotecnia, Facultad de Ingeniería, Universidad Nacional de La Plata, La Plata, Argentina
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia, Universidad Politécnica Valencia
[3]Instituto de Ingeniería, Universidad Nacional Arturo Jauretche (UNAJ), F. Varela, Argentina
[4]Centro de Investigaciones Ópticas, CIOp (CONICET – CIC), La Plata, Argentina

Abstract: Las lentes de Fresnel dieléctricas son utilizadas por su pequeño espesor, reduciendo sustancialmente su peso en comparación con una lente convencional de igual diámetro y material. El uso de este tipo de lentes para aumentar la ganancia de una antena en la banda de microondas, es relativamente reciente, resultando un campo poco explorado. El análisis en frecuencia del desempeño, dentro de la banda de microondas, de la configuración antena-lente de Fresnel requiere del uso de software de simulación electromagnética de tipo full-wave. El siguiente trabajo utiliza un código basado en el método de los momentos, recientemente publicado [1], que tiene la ventaja, respecto de los software de uso comercial, de emplear reducidos tiempos de simulación. A partir de los diagramas de radiación de campo lejano generados por el código de simulación se calculan los parámetros ganancia, ancho del haz de -3 dB y relación lóbulo principal a secundario, dentro del ancho de banda teórico, analizándose los resultados. De los resultados se observa que el conjunto presenta un comportamiento asimétrico respecto de la frecuencia central.

16:45h S3.2.6 Análisis Estadístico de Formas Cuadráticas Gaussianas Complejas No Centrales

Pablo Ramírez Espinosa, José F. Paris, José A. Cortés, Eduardo Martos Naya
Dpto. de Ingeniería de Comunicaciones, Universidad de Málaga

Abstract: En este artículo se presenta un nuevo enfoque al análisis estadístico de las formas cuadráticas gaussianas complejas (FCGC) indefinidas y no centrales. Este nuevo enfoque se basa en el estudio de una variable aleatoria auxiliar llamada forma cuadrática confluente, cuyo análisis es más sencillo pudiendo calcular sus estadísticos de primer orden en términos de funciones elementales. A partir de los estadísticos de la nueva variable es posible obtener, bajo ciertas condiciones, los de la FCGC original, dando como resultados expresiones simples de usar para cálculos analíticos posteriores. Finalmente, las expresiones obtenidas se emplean para estudiar la probabilidad de outage en sistemas donde se aplica combinación por razón máxima (MRC) sobre canales con fading y correlación arbitraria.

17:00h S3.2.7 Caracterización de modelos no-lineales casi-estáticos a partir de las formas de onda en régimen de gran señal

Sergio Pérez Parras, Teresa M. Martín Guerrero, Janie D. Baños Polglase, Carlos Camacho Peñalosa
Dpto. de Ingeniería de Comunicaciones, Universidad de Málaga, Andalucía Tech, E.T.S. Ingeniería de Telecomunicación

Abstract: A method to extract the conduction and displacement components of nonlinear quasi-static current sources controlled by two variables is concisely described. The method is numerically tested by means of two different analytical examples of nonlinear current sources. The obtained results clearly illustrate its performance as well as its potentiality in the nonlinear modelling of FET/HEMT devices.

SESIÓN 3.3: Sesión especial: Radar

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Mateo Burgos García y Guillermo Posada Quijano**
Lugar: Sala Andalucía III

15:30h S3.3.1 Desarrollo de Algoritmos de altas Prestaciones para la Calibración de Retardos en Phased Arrays Digitales

Marta Castiella Fernández[1], Mateo Burgos García[1], Carlos F. Castillo Rubio[2]
[1]Dpto. de Señales, Sistemas y Radiocomunicaciones. Universidad Politécnica de Madrid
[2]Indra Sistemas S.A. Torrejón de Ardoz, Madrid

Abstract: New generation phased array radars need to measure the relative time of arrival of broadband signals in different receivers very accurately. Because of the mismatch among different receiver chains there is a need of very precise calibration. Moreover, in digital receivers, these signals are sampled using frequencies that typically are close to the Nyquist limit. So the required accuracy is usually hundreds of times lower than the sampling period. In this paper, different methods to calculate the time delay between two signals are derived, and the results obtained with them are compared. The algorithm that leads to the best results is a modification of the MUSIC spectral estimator. This algorithm is studied in depth under different conditions.

15:45h S3.3.2 Evaluation of Different Techniques for Sidelobes Reduction in Phase Coded Radar Signals

Lourdes Muñoz Miguel[1], Mu Shen[2], Rodrigo Blázquez García[1], Mateo Burgos García[1]
[1]Dpto. de Señales, Sistemas y Radiocomunicaciones. Universidad Politécnica de Madrid
[2]School of Information and Communication Engineering. Beijing University of Posts and Telecommunications, China

Abstract: This paper analyzes different methods for reducing the effects of sidelobes in radar reception. Recently, the idea of Mismatched Sidelobe Free Filter has arisen. This filter allows total suppression of the sidelobes, but the implementation is based on Fourier transforms and in this paper the implementation with FIR Filter is studied. Also, the results of this filter are analyzed and compared with

other techniques for reducing sidelobes: TSSWA, Woo filter and weighting. In the analysis, the different techniques are carried out using different phase codes and Doppler shift in order to look for the best method depending on the needs. Sidelobe free filter suppresses sidelobes in the absence of Doppler shift but the application of this filter involves a loss of processing gain.

16:00h S3.3.3 On the use of LTE-R signals for passive multistatic radar systems

Rodrigo Blázquez-García, Jorge Casamayón-Antón, Mateo Burgos-García
Information Processing and Telecommunications Center. Universidad Politécnica de Madrid

Abstract: This paper presents an analysis on the use of Long-Term Evolution-Railway (LTE-R) signals as illuminations of opportunity for the development of passive multistatic radar systems. This approach would allow the deployment of low-cost perimeter surveillance and monitoring systems along high-speed railway networks by using software defined radios (SDR) as multi-channel receiving nodes. To that end, taking into account the LTE-R specifications, the ambiguity function of LTE-R signals is analyzed in terms of range and Doppler resolution and sidelobe level. The associated signal processing based on delay-Doppler cross-correlation with the reconstructed reference signals is described. Finally, the detection range of the system for the detection of people, vehicles and small drones is estimated.

16:15h S3.3.4 Drone Detection and RCS Measurements with X-Band Ubiquitous Radar

Álvaro Duque de Quevedo, Fernando Ibáñez Urzaiz, Javier Gismero Menoyo, Alberto Asensio López
Information Processing and Telecommunications Center. Universidad Politécnica de Madrid

Abstract: This paper presents experimental results on drone detection with a persistent frequency modulated continuous wave (FMCW) radar system, working at 8.75 GHz (X-band). The system and its main blocks are briefly introduced. Subsequently, the document presents the chosen scenario for the tests, and shows the results of the signal processing, achieving a DJIPhantom-4 detection at a range up to 2 km. The results are illustrated with range-Doppler matrices and detection figures. Range, speed and azimuth accuracies are discussed, considering the drone GPS data. Finally, the paper introduces a statistical radar-cross-section (RCS) study based on the processed data, in order to classify the drone as a Swerling target, and discusses the drone average RCS

16:30h S3.3.5 Oscilador Digital Sintonizable de 6 a 20 GHz con Estabilización en Temperatura Ultra-Rápida y Modulación en Frecuencia de Banda Ancha

Javier Montero-de-Paz, Jesús López-Paniego, Juan José Sánchez-Martínez, Antonio Bódalo Márquez
Indra Sistemas S.A., Tecnología y Gestión de Producto, Torrejón de Ardoz, Madrid

Abstract: In this paper, an ultrafast temperature stabilized Digitally Tuned Oscillator (DTO) working in the 6-20 GHz frequency band is presented. Thanks to an implemented temperature compensation analog circuit, this DTO is temperature stabilized in less than 1 minute. In addition, frequency modulation to the output signal can be provided via an input modulating signal with a frequency up to 10 MHz and switching time between frequencies of less than 1 us is achieved, making the device particularly suitable for electronic warfare applications, where a fast switching time between frequencies is critical.

16:45h S3.3.6 Estudio de Honeycomb Dieléctrico como Substrato de Microondas para Antenas de Radares 3D de Largo Alcance

G. Posada, J.I. Gómez, C. Zarzuelo
Indra Sistemas, España

Abstract: El Honeycomb dieléctrico es un substrato apropiado para aplicaciones de microondas ya que su constante dieléctrica y pérdidas son bajas y si se lamina ofrece excelentes propiedades mecánicas y bajo peso. Este artículo estudia las propiedades eléctricas de estructuras honeycomb de varios materiales diferentes para la implementación de redes de distribución stripline de antenas de gran tamaño como son las antenas de un radar 3D de largo alcance. Se comparan las pérdidas de una línea stripline implementada con celdas honeycomb de fibra de vidrio, kevlar y nomex, impregnadas con diferentes resinas (fenólica y de poliamida). El honeycomb de fibra de vidrio con resina de poliamida presenta muy bajas pérdidas, aunque son mayores que un Foam de polietileno de celda cerrada. El honeycomb presenta una anisotropía en los ejes que contienen las celdas, lo cual puede complicar el diseño y la fabricación de redes de distribución. Finalmente, se estudia el efecto del adhesivo necesario para laminar las estructuras y se muestra que el adhesivo que está en cerca de las pistas de Cu incrementa las pérdidas, mientras que el que está presente en los planos de masa no es crítico.

SESIÓN 3.4: Sesión especial: Comunicaciones por satélite (Parte 1)

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Miguel Calvo Ramón y Miguel A. Salas Natera**
Lugar: Seminario 1+2

15:30h S3.4.1 HAPs as a disruptive solution for sky communications and their interaction with current and future SATCOM systems

Antonio Abad[1], Pedro Pintó Marín[2]
[1]CTO. HISPASAT S. A.
[2]Technical and Operations Directorate. HISPASAT S.A.

Abstract: The sector of satellite communications is within a period of change thanks to the appearance of new infrastructures, among which stand out the VHTS (Very High Throughput Satellites) in GEO, mega-constellations of LEO satellites and HAPs (High-Altitude Platforms). The latter, located in the stratosphere, are presented as a viable technological option to complement the current traditional satellite systems over GEO and LEO orbits and to accommodate the increasing demand for data thanks to its unique advantages. Nowadays, there are still important challenges to be addressed to achieve a commercially valid system, especially related to the peculiarities of the operation in the stratosphere, as well as the generation and storage of the energy that feeds the System, as well as regulatory issues. Despite these difficulties, the development of HAPs is moving forward as they have key characteristics such as very low delay, high data capacity and operational flexibility, which makes them a potential candidate for the integration and complement of terrestrial technologies such as 4G/5G services, Internet access and mobile applications.

16:00h S3.4.2 Design of Gateway diversity systems for Very High Throughput Satellites (VHTS)

Michel Massanet Ginard, Ramón Martínez Rodríguez-Osorio
ETSI Telecomunicación, Universidad Politécnica de Madrid

Abstract: Due to the increase of demand in broadband satellite services, future Very High Throughput Satellites will approach to capacities next to 1 Tbps by 2020. In order to achieve this, smart gateway (GW) systems will be necessary and gateway diversity is going to be essential. This paper reviews an implementation method of GW diversity in satellite ground stations in order to mitigate rain fade which affects in a several way to satellite communications at Q/V and higher frequency bands. To reach high availability and capacity, smart gateway diversity makes use of the ITU-R P.1815-1 which predicts the joint differential rain attenuation statistics between a satellite and two locations on the Earth surface. The obtained results show visually the importance of geography in designing GW diversity systems and give a useful tool to know where to place the other GW depending on the availability required and the system parameters.

16:15h S3.4.3 Modelo de análisis de interferencia producida por skew angle en array planos para comunicaciones por satélite

Borja Rocha Peñalosa[1], Miguel A. Salas-Natera[2], Flor Ortiz[2], Ramón Martínez[2], José Luis Ruiz Dou[1], Carlos Zarzuelo Torres[1]
[1]Indra Sistemas S.A, TORREJÓN DE ARDOZ C. MADRID
[2]Universidad Politécnica de Madrid

Abstract: This paperpresents a model to analyze the interference generated by a planar generalized array antenna placed on an aircraft. The antenna system analyzed is defined to work at K/Ka band (19.2-21.2 and 29-31 GHz) intended to be used for satellite communications applications with an asymmetrical geometry. The case study presented is focused on the interference produced at certain skew angles. The last can be translated as a misalignment between the line of the sub-satellite points of the GEO orbit and the local orientation of the airborne antenna. This analysis starts with the definition of the patterns cut that includes the direction of all the GEO satellites into the line of side to check the possible interferences including an estimation of unfavorable effects on adjacent satellites. This analysis is performed also taking into account the ESD (EIRP Spectral Density) mask provided in MIL STD 188-164B standard. Finally, different Beam-Forming techniques for the interference mitigation are also analyzed

SESIÓN 3.5: Sesión especial: Sistemas MIMO

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Matilde Sánchez Fernández y Juan José Murillo Fuentes**
Lugar: Seminario 3+4

15:30h S3.5.1 Antenas para estaciones base 5G definidas por software

Aníbal Llanga-Vargas[1,2,3], Carlos Ramiro Peñafiel-Ojeda[1,2], Daniel Santillán-Haro[1,2] Marta Cabedo-Fabrés[1], Eva Antonino-Daviu[1], Miguel Ferrando-Bataller[1]

[1]Instituto de Telecomunicaciones y Aplicaciones Multimedia (iTEAM). Universitat Politècnica de València
[2]Universidad Nacional de Chimborazo, Riobamba-Ecuador
[3]Escuela Superior Politécnica de Chimborazo, Riobamba-Ecuador

Abstract: In this paper, a Software Defined Radio (SDR) array is presented. The elements of the array are dual-polarized low profile antennas with a large bandwidth and radiation pattern stability. The antennas are open-cavities with 4 feeding points and a single-layer metallic lens paralel to the cavity. A linear array of 4 elements is proposed, which would allow a total of 16 independent beams. It is shown that it is possible to design dual antennas in polarization, with large bandwidth and antenna arrays with pointing capability.

15:45h S3.5.2 A precoding + PAPR reduction scheme for Multi User MIMO-OFDM downlink

Álvaro Sanz García-Sintas, Francisco Javier González Serrano
Dpto. de Teoría de la Señal. Universidad Carlos III de Madrid

Abstract: In this paper, a downlink transmission scheme based on orthogonal frequency-division multiplexing (OFDM) for large-scale multi-user (MU) multiple-input multiple-output (MIMO) wireless systems is presented. It is a novel technology that provides many advantages compared to traditional communication systems. Nevertheless, MU-MIMO-OFDM suffers from two main drawbacks that increase the Symbol Error Rate (SER) of the communications: high Peak-to-AveragePower-Ratio (PAPR) value and Multi-User Interference (MUI). On the following sections, a solution is proposed. It consists on a combination of a linear precoding with a gradient based Tone Reservation (TR) algorithm. Simulation results show that this novel combination achieves significant PAPR reductions, what will drive to a reduction of the peaks of power of the signal and an enhancement of the communication's performance.

16:00h S3.5.3 Performance comparison between analog JSCC and digital schemes over MIMO channels

O. Fresnedo, F. J. Vázquez-Araújo, P. Suárez-Casal, L. Castedo
Dept. of Computer Engineering. University of A Coruña

Abstract: Analog Joint Source Channel Coding (JSCC) is a suitable alternative to traditional digital systems for the transmission of analog information in several communication scenarios. In this work, we compare the performance of a well-known analog JSCC scheme based on the Archimedean spiral to that of an equivalent digital system when transmitting analog information over a Multiple-Input and Multiple-Output (MIMO) fading channels. The obtained results show the suitability of analog JSCC when considering bandwidth compression in time varying channels.

16:15h S3.5.4 Imperfect CSI at the Expectation Consistency MIMO detector

Javier Céspedes[1], Pablo M. Olmos[1,2]
[1]Dept. of Information Theory and Communications. Universidad Carlos III de Madrid.
[2]Gregorio Marañón Health Research Institute

Abstract: In this study we evaluate the impairments that imperfect channel-state information (CSI) may cause to soft symbol detectors in large multiple-input multiple-output (MIMO) wireless systems. For this

purpose we compare our proposed algorithm based on Expectation Consistency (EC) which needs perfect CSI. The performance of the EC detector is compared with a Maximum Likelihood detector when a noise version of the CSI is given to the detector to proceed with the estimations.

16:30h S3.5.5 Improved probabilistic EP-based receiver for MIMO systems and high-order modulations

Irene Santos, Juan José Murillo-Fuentes
Dept. Teoría de la Señal y Comunicaciones, Escuela T. Superior de Ingeniería, Universidad de Sevilla

Abstract: Nowadays multiple-input multiple-output (MIMO) communications systems use efficient encoding schemes, highorder modulations and several number of antennas. In this scenario, the linear minimum-mean-square-error (LMMSE) is commonly used due to its low complexity. To improve its performance, some probabilistic detectors based on the expectation propagation (EP) algorithm has been proposed. In the design of an EP-based detector, the selection of its parameters is of great importance to control instabilities and avoid performance degradation, specially for high-order modulations. In this paper, we review the selection of these parameters in previous approaches and optimize them to achieve a robust performance. We focus specially on very high-order modulations, such as 64QAM and 128-QAM, which has not been studied in previous EP-based proposals. We include some experiments where the set of parameters clearly shows a robust behavior and outperforms previous EP-based MIMO proposals in terms of bit error rate (BER).

16:45h S3.5.6 Phase Noise Effects in Zero-Forcing Multi-User Massive MIMO Uplink and Downlink

Alberto Álvarez Polegre[1], Ana García Armada[1], Roberto Corvaja[2]
[1]Deparment of Signal Theory and Communications, University Carlos III de Madrid
[2]Department of Information Engineering, University of Padova

Abstract: The achievable rate per user is analyzed in a Massive MIMO-OFDM system with the presence of phase noise, both at the transmitter and receiver. We consider an uplink and downlink scenario employing a Zero-Forcing decoder and precoder, respectively. The results show that, when having a common oscillator at the base station, the maximum rate per user is constrained only by the amount of phase noise. On the other hand, the number of base station antennas plays a key role in the overall system performance when having a single oscillator for each of them, while increasing the number of users causes a negative effect.

17:00h S3.5.7 Inversión Aproximada de Matrices en Sistemas Massive MIMO Correlados en Tiempo o Frecuencia

Óscar Cobos Morales, Rafael Soldado Guerrero, Eduardo Martos Naya, Francisco Javier López Martínez, José Tomás Entrambasaguas Muñoz
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: Massive multiple-input multiple-output (MIMO) is expected to be one of the keys in 5G. In this technology, the base station is equipped with a big number of antennas serving multiple users simultaneously to improve spectral efficiency, coverage, and range. Zero-Forcing and Minimum Mean Square Error have been considered potential practical precoding and detection methods for large scale MIMO systems but require much larger dimensions of matrix inversion. This paper presents an

architecture for approximate matrix inversion based on Neumann Series, thereby reducing the cost of hardware. In addition, we propose a solution for systems with time or frequency correlation among different channels where we are able to reach a much higher throughput.

SESIÓN 3.6: Sesión especial: Innovación Educativa en Ingeniería

MIÉRCOLES, 15:30-17:15
Presidentes de sesión: **Alejandro Ayala Alfonso y Oswaldo B. González Hernández**
Lugar: Seminario 6

15:30h S3.6.1 Desafío Tecnológico: Herramienta para trabajar y evaluar las competencias básicas y generales en los estudios de grado de la E.T.S.I. de Telecomunicación

Ana M. Barbancho, Isabel Barbancho, Lorenzo J. Tardón, Alberto Peinado, Jorge Munilla, Andrés Ortiz, F. Javier Mata
Universidad de Málaga, Andalucía Tech, E.T.S.I. Telecomunicación, Dpto. Ingeniería de Comunicaciones

Abstract: This work presents the evolution of the five editions of the educational activity named "Technological Challenge" specially focused on the students at "Escuela Técnica Superior de Ingeniería de Telecomunicación" (ETSIT), but open to all students of the "Universidad de Málaga" (UMA). This initiative has been developed in the context of the educational innovation project PIE17-021 funded by UMA. The "Technological Challenge" consists on the formulation of specific real problems, which students must face in a competitive regime. This activity allows the reinforcement and evaluation of basic and general competences reached by the graduate students in the ETSIT. After nearly five years, this paper describes the evaluation of the results, regarding interest and participation of the students in the "Technology Challenge" along with the basic and general competences reached by the students.

15:45h S3.6.2 Desarrollo de actividades prácticas dirigidas a la adquisición de competencias profesionales

Pedro J. Reyes-Iglesias, José María Garrido-Balsells
Departamento de Ingeniería de Comunicaciones, Escuela Técnica Superior de Ingeniería de Telecomunicación Universidad de Málaga

Abstract: Most companies require engineering graduates with transversal skills, in addition to technical competences, for their professional practice. Therefore, regional, national and European engineering accreditation agencies pay special attention to the adequate development and assessment of transversal skills at university degrees. Programming practical activities to develop simultaneously transversal and technical skills in last year compulsory subjects is highly desirable for the imminent Degree Final Project (TFG). In this paper we describe the implementation of such practical activity and the achievement of the objectives according to the results and students feedback.

16:00h S3.6.3 Enseñar a innovar a ingenieros

Miguel Laso, Iván Arregui y David Benito
Dpto. de Ingeniería Eléctrica, Electrónica y Comunicaciones. Universidad Pública de Navarra (UPNA)

Abstract: In this paper, we discuss the importance of innovation as a key factor to improve the competitiveness of an engineering company (in the fields of telecommunications, industrial engineering, and electrical and electronic engineering). Students are offered at UPNA an (option) subject, where they are asked to think about why a company should innovate, in which particular areas, and the features of the innovation process in relation to the company's R&D policy and its investment. Innovation tools such as technological forecasting, technological prospective, and benchmarking, or protection of the innovation through patents or other kind of intellectual property rights are also addressed. The role of universities and public research centres in the transfer of technology is analysed, as well as the support of public administrations in technological innovation, with a special focus always placed in Navarra, so that the contents are familiar to the students. But the real added value of this subject is how it vehicles the experience of young innovators and invited entrepreneurs, as well as that of their teachers, with innovation, and how their knowledge are represented to the students, and their case studies analysed. All the invited professionals and case studies are close to the students (ex-alumni and nearby engineering companies).

16:15h S3.6.4 Experiencias de laboratorio para el estudio de señales de AM y FM

Alejandro José Ayala Alfonso, Silvestre Rodríguez Pérez, Beatriz Rodríguez Mendoza y Oswaldo González Hernández
Dpto. de Ingeniería Industrial. Universidad de La Laguna.

Abstract: This work presents a set of laboratory experiences aimed at engineering students in electronics and its implementation by using simple electronic components of modulated signals in AM and FM, and to determine the inherent characteristics of this type of modulations. Finally, it also presents the design of a superheterodyne FM receiver.

16:30h S3.6.5 Hands-on Electronics Laboratory in Fully Online Engineering Education

Carlos Monzo, Germán Cobo, David García-Solórzano, José Antonio Morán, Eugènia Santamaría
Faculty of Computer Science, Multimedia and Telecommunications. Open University of Catalonia

Abstract: Practical experimentation is essential for electronics learning. In this way, the Open University of Catalonia (UOC), a fully online University, has developed a hands-on electronics laboratory (Lab@Home) which allows online engineering students to carry out practical experiments anywhere and anytime, acquiring the required practical competences. Thus, this paper presents hands-on laboratory functionalities and features, along with its analysis and validation by means of a self-administered questionnaire sent to students of two subjects during six consecutive semesters.

16:45h S3.6.6 Laboratorio de Radar Monopulso en Amplitud usando tarjetas WiFi

Miguel Poveda-García, María Pérez-Buitrago, Antonio Gómez-Alcaraz, Luis Miguel Martínez-Tamargo, Alejandro Martínez-Sala, David Cañete-Rebenaque, José Luis Gómez Tornero

Departamento de Tecnologías de la Información y las Comunicaciones, Universidad Politécnica de Cartagena (UPCT)

Abstract: We present an inexpensive lab to teach amplitude monopulse radar concepts. The experimental set-up is based on the use of commodity WiFi hardware to measure the RSSI (Received Signal Strength Indicator). Using two commercial panel antennas and simple MATLAB signal processing, the students can estimate the Direction of Arrival (DoA) of the WiFi signal coming from a smartphone or any WiFi device. This lab can be organized in five sessions, with a duration of two hours each and the total cost for all of the devices needed is around 280€, without including some material normally found in the university labs.

17:00h S3.6.7 Tecnología de comunicaciones móviles al alcance de todos: la experiencia del MOOC

Raquel Pérez Leal, José Joaquín Escudero Garzas, Borja Genovés Guzmán, Víctor P. Gil Jiménez, Ana García Armada
Dpto. de Teoría de la Señal y Comunicaciones. Universidad Carlos III de Madrid. Escuela Politécnica Superior

Abstract: MOOCs are emerging as a very innovative powerful e-learning tool. Despite the fact that the number of MOOCs increases substantially every year, the presence of engineering areas like mobile communications is insignificant in the MOOC world. This paper presents the MOOC "Comunicaciones móviles en la palma de tu mano" (Mobile communications: on the palm of your hand) which covers the existing hole in this field. The course has been developed in Spanish and Portuguese, as these languages are under-represented in MOOCs courses, and aimed to general public with no technical background. The results show a high degree of satisfaction among learners and that the instructional methodology was correct.

SESIÓN 4.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Amelia Rubio Bretones y Mario Fernández Pantoja**
Lugar: Sala Andalucía I

12:15h S4.1.1 Aceleración de Problemas Electromagnéticos Multiescala mediante el Método de Descomposición de Dominios

Victor F. Martin[1], David Larios[1], José M. Taboada[1], Luis Landesa[1], F. Obelleiro[2], Diego M. Solis[2]
[1]Dpto. de Tecnología de los Computadores y las Comunicaciones. Universidad de Extremadura
[2]Dpto. de Teoría de la Señal y las Comunicaciones. Universidad de Vigo

Abstract: In this paper, we take advantage of the fast convergence of the Domain Decomposition Method (DDM) to accelerate the calculation of the electromagnetic characterization of floating structures (a frigate) with several small scale antennas. The divide and conquer philosophy is applied to calculate multi-scale geometries combining overlapping and non-overlapping objects. We will study the influence of

intradomain and interdomain resolution parameters on the convergence of the method. Later we will apply the method to an high complexity example to demonstrate its usability in a real problem.

12:30h S4.1.2 Aplicaciones de la simulación electromagnética en sistemas anticolisión en vehículos

Lorena Lozano[1], Álvaro Somolinos[2], Iván González[1], Felipe Cátedra[1]
[1]Computer Sciences Dept., Alcala University, Alcala de Henares
[2]NEWFASANT, Guadalajara

Abstract: We present an application of the electromagnetic simulation tools for the analysis of a very interesting case of autonomous driving: car to car and car to infrastructure communications. We have considered a new hybrid technique combining Method of Moments, Physical Optics and Geometrical Theory of Diffraction for the analysis of the radio-wave channel in urban traffic scenes. We show the efficency and accuracy of the new technique for solving the electricaly large and multiscale problem that appears in the analyses of these channels.

12:45h S4.1.3 El Método de Elementos Finitos con Segmentación Modal (FEM-MS) aplicado al diseño de antenas

Rafael Gómez Alcalá[1], Jesús Rubio[1], Miguel A. González de Aza[2], Jesús García[2], José M. Gil[2], Pedro Robustillo[3], Juan Zapata[2]
[1]Dpto. Tecnología de los Computadores y de las Comunicaciones. Universidad de Extremadura
[2]Dpto. de Señales Sistemas y Radiocomunicaciones, E.T.S.I.T., Universidad Politécnica de Madrid
[3]Airbus Defence and Space GmbH, D-88039 Friedrichshafen, Germany

Abstract: In this work, a method based on Finite Elements and Modal Segmentation (FEM-MS), suitable for the analysis and design of microwave devices and antennas, is presented. The method begins with the decomposition into segments of the device, in order to calculate the corresponding multimode-multiport matrices of each of them. The analytical connection of these matrices gives rise to the global matrix of the device, which allows fullwave analysis for any excitation at the input. The method is well suited to the analysis and design of antennas and arrays of antennas, as shown in the three examples included in the work: a multilayer array structure composed by cavity-backed microstrip patches in stacked configuration, an on-board spacecraft antenna system, and a lens-based antenna with steering capabilities.

13:00h S4.1.4 Estudio Numérico y Experimental de las Resonancias de Schumann

Jesús Fco. Fornieles Callejón[1], Alfonso Salinas Extremera[1], Jesús Rodríguez Camacho[2]
[1]Dpto. de Electromagnetismo y Física de la Materia. Universidad de Granada
[2]Dpto. de Física Aplicada. Universidad de Granada

Abstract: The conducting surface of the Earth and the lower ionosphere made up an electromagnetic cavity. Inside this cavity, Schumann resonances (SR) are found as coloured background electromagnetic noise at extremely low frequency (ELF) band. Firstly, SR constitute a powerful tool to investigate the atmosphere electricity, because of their direct relationship with the global climate and lightning activity. In second place, SR can be able to fill several significant gaps in the understanding of coupling processes in the near-Earth environment which operate from 5 Hz to 25 Hz frequency range of electromagnetic waves.

This frequency range is of particular interest in view of the energy transfer from the atmosphere to the ionosphere, and from the magnetosphere to the ionosphere. Studing and understanding SR on Earth can also be a powerful tool to investigate the geophysical properties of the surfaces, atmospheres and ionospheres of bodies in the solar system.

13:15h S4.1.5 GRECO: 30 years of graphical processing techniques for RCS computation

Juan M. Rius, Eduard Úbeda, Alexander Heldring
CommSensLab, Universitat Politècnica de Catalunya - BarcelonaTech

Abstract: This contribution to the special session in honor of Prof. Rafael Gómez-Martín will address the 30 year development of graphical processing techniques (GRECO) for fast computation of Radar Cross Section (RCS) of electrically large and complex targets. The development of GRECO started in 1988, in the frame of the "Applied research project for the development and validation of numerical methods for RCS prediction, analysis and optimization", in which I had the pleasure to know Rafael since our groups where participating together in the project. The development of GRECO never stopped, and recently it has been updated by replacing the graphical processing technique for computation of surface reflection and edge diffraction by a hybrid CPU-graphical processing approach. The resulting code has the same accuracy as conventional RCS computation techniques, but detection of shadowed surfaces and edges is one order of magnitude faster than the most efficient O(N log N) implementations.

13:30h S4.1.6 Iones y electrones en la baja atmósfera de Titán

Gregorio J. Molina-Cuberos[1], Ángel J. García-Collado[2], José J. López-Moreno[3], José Margineda[1], Sergio Toledo-Redondo[4]
[1]Dpto. de Electromagnetismo y Electrónica, Universidad de Murcia
[2]Geomática, Teledetección y SIG Aplicados, Universidad Católica de Murcia
[3]Instituto de Astrofísica de Andalucía, IAA-CSIC, Granada
[4]Science Directorate, European Space Agency, ESA/ESAC, Villanueva de la Cañada

Abstract: The atmosphere and surface of Titan, the largest moon of Saturn, was explored by the ESA Huygens Probe in 2005 during the three hours of descent and surface operations. The Permittivity Wave and Altimetry (PWA), one of the onboard instruments, determined the concentration of electron and positive ions by making use of two independent sensors: the Mutual Impedance (MI) and Relaxation Probe (RP). The retrieved data show a maximum of charge densities of $\approx 2 \times 10^9$ m^{-3} positive ions and $\approx 450 \times 10^6$ m^{-3} electrons at approximately 65 km. Such difference between positive and negative charges has not yet been understood and no theoretical model has been able to reproduce these measurements. Here, by solving the continuity equations for electrons, positive ions and charge on aerosols, we have modelled the lower ionosphere of Titan and we are able to satisfactory reproduce the electron and ion densities retrieved from MI and RP.

SESIÓN 4.2: Comunicaciones Móviles e Inalámbricas (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Francisco Falcone Lanas y Ana M. Torres Aranda**
Lugar: Sala Andalucía II

12:15h S4.2.1 Comparativa de técnicas de estimación de canal para VLC en interiores

Juan Carlos Estrada-Jiménez, Borja Genovés Guzmán, M. Julia Fernández-Getino García, Víctor P. Gil Jiménez.
Dpto. de Teoría de la Señal y Comunicaciones, Universidad Carlos III de Madrid

Abstract: In this paper, we compare two channel estimation techniques in Visible Light Communications (VLC). Channel estimation is of interest in VLC due to the necessity to obtain the channel state information to equalize or precode and recover the information transmitted. Different channel estimation techniques have been proposed in the literature for VLC where a group of them have been transferred from Radio Frequency (RF) scenarios. The channel estimation through Pilot Symbol Assisted Modulation (PSAM) is a well-known topic in RF and has been proposed under certain conditions in VLC. Also, Superimposed Training (ST) has been introduced in VLC to increase the bandwidth. In this paper, we compare the main characteristics of PSAM and ST schemes on VLC, and analyze the main advantages and possible problems of these techniques under this scenario in the non-Line of Sight case. Simulation results are presented to evaluate the channel estimation mechanism and bit error rate performance.

12:30h S4.2.2 Layered ACO-CP-OFDM with insufficient Cyclic Prefix for Visible Light Communications

Kun Chen-Hu, Borja Genovés Guzmán, Víctor P. Gil Jiménez and Ana García Armada
Department of Signal Theory and Communications, Universidad Carlos III de Madrid

Abstract: The industry is looking for new frequency bands in order to provide new services that require a huge bandwidth, where Visible Light Communication (VLC) appears as a solution. Cyclic Prefix-Orthogonal Frequency Division Multiplexing (CPOFDM) is a suitable scheme to mitigate the multipath effects with a low-complexity one tap equalization. In this paper, we propose the use of Layered ACO-CP-OFDM (LACO-CP-OFDM) with insufficient CP combined with a Double Iterative Interference Cancellation (DIIC), which is based on the combination of the iterative receiver of LACO-CP-OFDM with the well-known residual interference cancellation. An analysis of the scenario and simulation results are provided.

12:45h S4.2.3 Vulnerabilidades en Vehículos Aéreos no Tripulados de Uso Comercial

Sandra Pérez Arteaga[1], Luis Alberto Martínez Hernández[1], Linda Karina Toscano Medina[1], Gabriel Sánchez Pérez[1], Luis Javier García Villaba[2]
[1]Instituto Politécnico Nacional, Sección de Estudios de Posgrado e Investigación Escuela Superior de Ingeniería Mecánica y Eléctrica Unidad Culhuacán Av. Santa Anna 1000 Ciudad de México, México
[2]Grupo de Análisis, Seguridad y Sistemas (GASS) Departamento de Ingeniería del Software e Inteligencia Artificial (DISIA) Facultad de Informática, Despacho 431, Universidad Complutense de Madrid (UCM)

Abstract: The different uses that can be attributed to unmanned aerial vehicles are diverse depending on the areas in which it is used. This causes that they are constituted by different technologies to carry out the activities for which they were designed. However, security is not usually taken into account since some vulnerabilities are due to the technologies used to communicate or to perform common functions, such as flying several kilometres away, taking photographs, video, etc. Although the use of drones is endless, it poses a great threat if they are attacked and mistreated by adversaries, putting at risk the security of the Unmanned Aircraft Systems or the information it contains. They are also vulnerable when they are not in operation as many of them connect to the Internet to communicate.

13:00h S4.2.4 Estudio de emisiones radioeléctricas de redes GSM y UMTS en los municipios de La Solana, Tomelloso y el Parque Natural de Las Lagunas de Ruidera

Enrique Díaz-Cano Alhambra[1], Jorge Mateo Sotos[2], Ana María Torres Aranda[2]
[1]Escuela Politécnica de Cuenca. Universidad de Castilla-La Mancha
[2]Dpto. de I.E.E.A.C. Escuela Politécnica de Cuenca. Universidad de Castilla-La Mancha

Abstract: In this work, some mobile phone technologies such as GSM 900 (second generation) and UMTS 2100 (third generation) have been analyzed in order to characterize the signal of the Orange service from different base stations in three countries. The first one is La Solana, the second is Tomelloso and finally the natural park of Las Lagunas de Ruidera. These measures have been obtained in order to study the mobile coverage and propagation channels. In addition, several data by Qualipoc Android software have been taken using a mobile terminal. The measurement areas have been studied with SIRENET software, keeping in mind two types of mobile propagation prediction models: deterministic and empirical, so the real measurements have been comparedwith theoretical measurements. Finally, several improvements to upgrade coverage of the disfavored areas have also been introduced.

13:15h S4.2.5 Algoritmo de control de carga basado en calidad de experiencia en redes LTE

María Luisa Marí-Altozano, Salvador Luna-Ramírez, Matías Toril
Dpto. de Ingeniería de Comunicaciones, ETSI Telecomunicación, Universidad de Málaga

Abstract: Due to the huge increase in traffic and services in mobile networks, network management has changed its main focus from Quality of Service (QoS) to a Quality of Experience (QoE) perspective. In addition, SON (Self organization Networks) techniques have been developed to automate network management, being load balancing a key use case. Load balancing aim is to balance the traffic among adjacent cells. This balance is expected to decrease the overall blocking ratio, thus increasing the total carried traffic in the network. Nevertheless, these techniques may fail when QoE perspective is considered. In this work, a novel QoE balancing algorithm is proposed to reach QoE equilibrium in a realistic LTE network whith different services. The proposed balancing approach is tested and compared with classical techniques by means of simulations.

13:30h S4.2.6 Asignación automática de portadoras en un escenario 5G

I. de-la-Bandera, D. Palacios, R. Barco
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: The fifth generation new radio (5G NR) is the new standard of mobile communications that appears to address the growing network complexity and variety of services. One of the main features to

cope with these two challenges is Multiconnectiviy (MC). MC allows a user to connect to more than one node by using multiple component carriers simultaneously. One of the main advantages of this new functionality is to improve user throughput and balance network load. This paper proposes an algorithm to assign different component carriers to users in an automatic manner. The selection is performed by using both cell and user level information. Results show that the proposed method improves user throughput and reduce congestion problems at the same time.

13:45h S4.2.7 Algoritmo de detección interior/exterior para trazas de conexión de una red LTE

J. L. Bejarano-Luque, M. Toril, M. Fernández-Navarro, R. Acedo-Hernández, S. Luna Ramírez
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: In cellular network planning, estimating spatial user distribution is extremely important. Traditionally, user location is estimated based on Angle of Arrival (AoA), Time of Arrival (ToA) and measured Reference Signal Reference Power (RSRP) by the terminal. In this paper, a statistical model is built to estimate whether a mobile connection is originated in an indoor location based on traffic attributes. The proposed model is developed by applying logistic regression on data from radio connection traces in the network management system. The model is tested with a large trace dataset from a live Long Term Evolution (LTE) network.

SESIÓN 4.3: Sesión especial: Premio URSI2018 a Jóvenes Investigadores

JUEVES, 12:15-14:00
Presidentes de sesión: **Francisco Medina Mena y Jordi Romeu Robert**
Lugar: Sala Andalucía III

12:15h S4.3.1 Outline of a Radiofrequency Energy Harvesting System Based on an Ultrawideband Archimedean Spiral Antenna

Antonio Alex-Amor[1,2], Pablo Padilla[3], José M. Fernández-González[1], Manuel Sierra-Castañer[1]
[1]Dept. of Signals, Systems and Radiocommunications. Technical University of Madrid
[2]Dept. of Language and Computer Science. University of Malaga
[3]Dept. of Signal Theory, Telematics and Communications. University of Granada

Abstract: This document presents the different parts that conform a radiofrequency (RF) energy harvesting system, and pays special attention on the RF harvester and the rectifier circuit. It is of capital importance covering FM, DTT, LTE-800, GSM-900, GSM-1800, LTE-2100, WiFi, LTE-2600 and WiMAX bands, where almost all relevant commercial applications are located. In these terms, the ultrawideband Archimedean spiral antenna arises as the ideal option. After carrying out several miniaturization techniques on the antenna, a final prototype (0.35 – 16 GHz) is presented and used to measure the radio spectrum in two different scenarios: inside and outside the laboratory. These results prove that hundreds of microwatts can be acquired in a normal situation. Attending to these power levels, a microwave half-wave Cockcroft-Walton (HWCW) voltage multiplier is specially designed to properly condition the harvested power. Besides that, a comparison among different low forward voltage Schottky diodes and RF capacitors is made in order to minimize voltage ripple and losses of the output signal.

12:30h S4.3.2 V-band aperture array antenna using gap waveguide technology based on glide-symmetric structures

Ángel Palomares Caballero, Pablo Padilla de la Torre, Juan Valenzuela-Valdés
Department of Signal, Theory Telematics and Communications, University of Granada-CITIC

Abstract: A 16-element V-band aperture antenna array based on gap waveguide with glide-symmetric holey structures has been designed. With this novel gap waveguide technology combined with E-plane split-block, the power losses and fabrication complexity and costs are fairly decreased. The antenna array consists of two layers that form a feeding network, and several vertical stacked layers which formed the aperture antenna elements. The waveguide size used is WR10. The antenna array design covers a wide bandwidth, 66.5-71 GHz, with a matching impedance level below -10 dB. Also, the antenna array has few gain variation over the entire bandwidth with a gain over 20 dB and global radiation efficiency greater than 80%. The radiation pattern is a pencil beam, with side-lobes lower than -12.5 dB for all the operating frequencies.

12:45h S4.3.3 A Novel Reconfigurable Phase Shifter based on Substrate Integrated Coaxial Line using Liquid Crystal

Vicente Nova, Carmen Bachiller, Juan R. Sánchez and Vicente Boria
Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universitat Politècnica de València

Abstract: This paper presents a phase shifter implemented in a novel transmission line integrated in substrate, the Empty Substrate Integrated Coaxial Line (ESICL). The line is filled with liquid crystal (LCSICL) and, thanks to its dielectric anisotropy property the phase shift can be easily controlled using an external electric or magnetic field. This phase shifter can be tuned, obtaining a 27.7◦ maximum phase shift, in the range of 0 GHz to 20 GHz, with an average insertion loss of 2 dB. In order to measure this device, an efficient transition from Grounded Coplanar Waveguide (GCPW) to LCSICL has been developed. Besides, this structure can be a useful support to others parametric microwave devices (dependant on material properties) such as resonators, filters or hybrid circuits.

13:00h S4.3.4 3D Bifocal Design Method for Dual Reflectarray Configurations with Application to Multi-Beam Satellite Antennas in Ka-Band

Eduardo Martínez de Rioja[1], José A. Encinar[1], Rafael Florencio Díaz[1], Carolina Tienda[2]
[1]Information, Processing and Telecommunications Center, Universidad Politécnica de Madrid, ETSI de Telecomunicación
[2]Antenna Group, Airbus Defence & Space, SG1 2AS Stevenage, United Kingdom

Abstract: This contribution describes a 3D bifocal design technique for dual reflectarray configurations with application to multi-beam satellite antennas in Ka-band. The bifocal technique has been used to obtain closer beams than those obtained with a single-focus antenna and, at the same time, to improve the performance of the extreme beams. A bifocal dual reflectarray antenna demonstrator in an offset compact-range configuration has been designed, fabricated and tested. The demonstrator generates 10 beams alternating in dual-linear polarization when the antenna is illuminated by 5 adjacent feedhorns. The results are in good agreement with the design requirements in the 19.2-20.2 GHz band.

13:15h S4.3.5 Conformal Patch Array Antenna with Switchable Omnidirectional or Sectorial Coverage at 3.5 GHz

P. Sánchez-Olivares, P. P. Sánchez-Dancausa, J. L. Masa-Campos, M. Iglesias-Menéndez de la Vega and E. García-Marín
Dpto. de Tecnología Electrónica y de las Comunicaciones. Universidad Autónoma de Madrid

Abstract: A circularly conformal array antenna with beam steering capabilities as well as omnidirectional performance in S-band is presented. The single radiating elements are formed by double stacked microstrip patches placed on the planar faces of an octagonal supporting structure fabricated with a 3D printer. An eight-way tunable feeding network in microstrip technology is designed, manufactured and integrated into the conformal structure in order to excite the array elements. Novel tunable T-junctions based on PIN diodes are proposed to form the tunable feeding network. This novel T-junction allows a splitting configuration with uniform distribution to the two output ports, or a switching mode to deliver the signal to either output port. In all T-junction operation modes, a good input matching performance is achieved. The tunable feeding network is integrated into the conformal antenna and digitally controlled by a microcontroller Arduino UNO. A total of 29 states, grouped in 6 modes with a global matching bandwidth of 17.2% can be selected. An omnidirectional radiation as well as beam steered directional patterns (covering 360 deg) can be electronically selected. The proposed antenna is able for future 5G terrestrial communications in the 3.5 GHz IMT range.

13:30h S4.3.6 Microwave Filter on a Decoupled Empty Substrate Integrated Waveguide

Juan R. Sánchez, Carmen Bachiller, Vicente Nova and Vicente E. Boria.
Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universitat Politècnica de València

Abstract: This work presents a novel Decoupled Empty Substrate Integrated Waveguide (DESIW), which enables AC/DC decoupling in any device that is integrated in it. The decoupling strategy is performed throughout a micro-milling square pattern of easy implementation that increases the insertion losses compared to the standard ESIW. However, the DESIW related losses are still tolerable, allowing the employment of the new periodic structure in many practical applications. In particular, it can be used for the design and manufacturing of reconfigurable devices which need a bias voltage on the whole device, or just on some of its particular areas. A broadband transition from DESIW to microstrip planar lines has been also successfully designed. The new line across with a directly coupled cavities filter have been manufactured and measured.

13:45h S4.3.7 Monopulse Space Debris Radar Antenna Based on RLSA and 3D-Printed Gap Waveguide at 94 GHz

Adrián Tamayo-Domínguez, José-Manuel Fernández-González, Manuel Sierra-Castañer
Radiation Group, Signals, Systems and Radiocommunications Department, Universidad Politécnica de Madrid

Abstract: This work presents the design of a monopulse antenna for a space debris radar with left-handed circular polarization. It is based on a radial line slot array (RLSA) antenna excited by a Butler matrix implemented in gap waveguide. This feeding network excites a circular cavity coupled to the RLSA, simultaneously generating both sum and difference beams. The RLSA consists of concentric rings of slots whose length and position are optimized by an algorithm based on the Method of Moments. The

RLSA is placed on the feeding network, which has been designed oriented to additive manufacturing. The simulation results of the entire antenna show acceptable matching and very stable radiation patterns for monopulse operation. Measured results of the Butler matrix and some of its components present good matching below -20 dB at 94 GHz with losses around 5 dB/m, which is equivalent to a copper coating roughness of 0.3 µm.

SESIÓN 4.4: Componentes y Circuitos Activos de Microondas

JUEVES, 12:15-14:00
Presidentes de sesión: **Javier Reina Tosina y María Nieves Ruiz Lavín**
Lugar: Seminario 1+2

12:15h S4.4.1 A Comprehensive Performance Benchmark of Component Selection Techniques for Volterra Behavioral Models

Abraham Pérez-Hernández, Juan A. Becerra, María J. Madero-Ayora, Carlos Crespo-Cadenas
Dept. Signal Theory and Communications, Universidad de Sevilla

Abstract: This work presents a comparative of component selection techniques for Volterra series models to digital predistortion of RF power amplifiers (PAs). The orthogonal matching pursuit (OMP), iterated Ridge regression (IRR) and principal component analysis (PCA) techniques are compared from a theoretical point of view. The experimental part consists on the modeling of the expected output of the GaN PA under test driven by a 15-MHz long term evolution (LTE) input signal. The measured signals are acquired by using a vector signal analyzer and post-processed to get time alignment between the measured and the reference signal. Experimental results enrich the desired benchmark and highlight the benefits of each one of the algorithms.

12:30h S4.4.2 Algoritmo Subspace Pursuit para la Selección de Parámetros de Modelos de Volterra

Juan A. Becerra, María J. Madero-Ayora, Abraham Pérez-Hernández, Javier Reina-Tosina, Carlos Crespo-Cadenas
Departamento de Teoría de la Señal y Comunicaciones. Escuela Técnica Superior de Ingeniería. Universidad de Sevilla

Abstract: This communication presents a new technique for the digital predistortion of power amplifiers (PAs) based on sparse behavioral models. The subspace pursuit algorithm formulation is adapted to work in the Volterra series framework. Experiments driven on a test bench based on a GaN PA driven by a 15-MHz filter bank multicarrier (FBMC) signal were conducted in order to validate the algorithm. Experimental results in a digital predistortion scenario and the comparison with the orthogonal matching pursuit highlight the enhancement of this pruning method.

12:45h S4.4.3 Amplificador de Alta Potencia 6-18 GHz en GaN sobre SiC para Guerra Electrónica

Eduardo Oreja Gigorro[1], Emilio Delgado Pascual[1], Juan José Sánchez Martínez[1], María Luz Gil Heras[1], Virginia Bueno Fernández[1], Antonio Bódalo Márquez[1], Jesús Grajal[2]
[1]Indra Sistemas S.A. Torrejón de Ardoz, Madrid
[2]Universidad Politécnica de Madrid

Abstract: A 6-18 GHz high power amplifier (HPA) design in GaN on SiC technology is presented. This power amplifier consists of a two stage corporate amplifier which shows an unconditional stable behavior. It has been designed at Indra Sistemas and fabricated following the GH25 process from UMS, using a 0.25 µm gate length. Small and large signal measurements in pulsed conditions and their comparison with simulations are also discussed. This HPA exhibits an averaged output power of 39.2 dBm with a mean gain of 11 dB in saturation and a 24.5% maximum power added efficiency (PAE) in pulse mode operation.

13:00h S4.4.4 Distorsión No Lineal en Amplificadores de Potencia de Banda Ancha en GaN

Emilio Delgado Pascual[1], Eduardo Oreja Gigorro[1], Juan José Sánchez Martínez[1], María Luz Gil Heras[1], Virginia Bueno Fernández[1], Antonio Bódalo Márquez[1], Jesús Grajal[2]
[1]Indra Sistemas S. A.
[2]Dpto. de Señales, Sistemas y Radiocomunicaciones, Universidad Politécnica de Madrid

Abstract: This paper analyzes the non linear distortion behavior of two different architectures of ultra wideband GaN power amplifiers. The study is motivated by an increasing need to characterize non linear distortion in wideband HPAs due to higher carrier frequencies and modulation complexity in modern communications systems. This paper presents the design process and measurements of two general purpose HPAs, manufactured using European GaN technology. Non linear distortion effects are then analyzed in a complex modulation scenario.

13:15h S4.4.5 Predicción de los Contornos Load-Pull en un Amplificador Clase-E mediante un Modelo de tipo Conmutador

David Vegas, María Oti, María Pampín, José R. Pérez-Cisneros, M. Nieves Ruiz, José A. García
Dpto. Ingeniería de Comunicaciones. Universidad de Cantabria

Abstract: A simple switch model for a GaN HEMT device is presented in this paper. The model is extracted to estimate the efficiency and output power load-pull contours when the transistor is used in a UHF class-E power amplifier. A load insensitive class-E design methodology is therefore deployed considering the impact of model parameters on the theoretical achievable efficiency versus output power backoff (PBO) profile. In order to approximate the desired zero voltage switching (ZVS) operation along a wide range of resistive loads, a simple lumped element terminating network, derived from [1], was selected. A resonant DC-DC power converter has been implemented for validation achieving an efficiency peak of 78% staying above 60% up to a 30% of the nominal DC output power (10 W).

13:30h S4.4.6 Transmisor Outphasing Clase-E de Alta Eficiencia en Tecnología GaN HEMT

David Vegas, Miguel A. González, José R. Pérez-Cisneros, M. Nieves Ruiz, José A. García
Dpto. Ingeniería de Comunicaciones. Universidad de Cantabria

Abstract: This paper presents a Chireix (outphasing) transmitter at UHF band, based on load-independent class-E RF power amplifiers. Drain efficiency peak of 82.2% has been measured, with values above 70% at 10 dB of output power back-off (BO). A wide dynamic range has been obtained at 700 MHz, allowing the reproduction of envelope values 39.4 dB below the peak in a pure outphasing operation. As a validation, a 1.4 MHz LTE signal of 9.6 dB PAPR has been recovered with an averaged power efficiency of 52.5%, satisfying the linearity requirements.

13:45h S4.4.7 Corrección de desequilibrios basado en envolvente elíptica para Unidades Radio Remotas LINC en arquitecturas C-RAN con Fronthaul óptico.

Pedro L. Carro, Paloma García-Dúcar, Jesús de Mingo, Antonio Valdovinos, Ángela Hernández, Fernando Gutiérrez
Dpto. de Ingeniería Electrónica y Comunicaciones, Universidad de Zaragoza Instituto de Investigación en Ingeniería de Aragón (I3A)

Abstract: This article proposes a new imbalance correction method in a Radio over-Fiber (RoF) link intended to feed a Remote Radio Head (RRH) with a Linear Amplification with non linear components (LINC) amplifier in multicarrier modulation applications. The goal is to correct the imbalances introduced by the optical/RF elements using signals which are generated a few kilometers far at the Baseband Unit (BBU). The signals are digitally corrected by analyzing an envelope which is sensible to gain and phase impairments. The method is verified using the EVM and ACPR as classical performance measures with LTEA waveforms and over an IM/DD RoF system with two chains com-posed of a DFB-EAM laser, standard Single Mode Fiber, a Broadband photodiode detector and a Power Amplifier (PA).

SESIÓN 4.5: Sesión especial: Ongoing research towards 5G (Parte 1)

JUEVES, 12:15-14:00
Presidentes de sesión: **Jorge Navarro Ortíz y Eduardo Jacob**
Lugar: Seminario 3+4

12:15h S4.5.1 Identificación de eventos sociales como la causa de fallo en redes celulares

Sergio Fortes[1], Hao Qiang Luo-Chen[1], Eduardo Baena[1], Inmaculada Serrano[2], Raquel Barco[1]
[1]Universidad de Málaga, Andalucía Tech, Departamento de Ingeniería de Comunicaciones
[2]Ericsson, Málaga

Abstract: In recent times the amount of information available about the details associated with social events (such as sport matches, concerts, fairs, etc.) has increased stunningly based on social networks, calendars and event aggregators. Those events have a strong impact in the cellular network service provision, particularly in the degradations that can be encountered. However, their automatic analysis for troubleshooting of network issues has been mainly neglected till recent times. In this way, the present article revolves about the use of social events information and its association with network data in order to identify those events that might have caused degradations. An approach to achieve this goal is proposed and applied in a real case scenario.

12:30h S4.5.2 Reducción de dimensionalidad en funciones SON mediante técnicas de extracción de atributos

D. Palacios, I. de-la-Bandera, R. Barco
Dpto. de Ingeniería de Comunicaciones, Universidad de Málaga

Abstract: Next-generation self-organizing networks (SONs) will have to cope with an extraordinary amount and variety of network performance indicators, causing an increase in the storage needs of the network databases and the degradation of the SON functions due to the high-dimensionality of every network observation. In this paper, different techniques for feature extraction are described and proposed as a means for reducing this high dimensionality, to be integrated as an intermediate stage between the monitoring of the network performance indicators and their usage in SON functions. Results using a dataset gathered from a live cellular network show the benefits of this approach, in terms both of storage savings and subsequent SON function improvements.

12:45h S4.5.3 Estimación del Offset Temporal en Sistemas Multiportadora Basados en la DCT

Fernando Cruz–Roldán[1], José Piñeiro–Ave[1], José L. Rojo – Álvarez[2], Manuel Blanco–Velasco
[1]Departamento de Teoría de la Señal y Comunicaciones, Universidad de Alcalá
[2]Departamento de Teoría de la Señal y Comunicaciones, Universidad Rey Juan Carlos

Abstract: En este trabajo se aborda el problema de la corrección del offset temporal de símbolo (STO) en sistemas multiportadora con la transformada discreta del coseno (DCT), y se propone un algoritmo basado en el cálculo de la correlación. El nuevo enfoque explota el hecho de que cada símbolo de datos en un transceptor basado en la DCT incluye un prefijo y un sufijo que son la réplica de parte de los datos útiles. El nuevo método reduce la necesidad de pilotos y, por lo tanto, la sobrecarga del sistema. Las prestaciones del algoritmo propuesto se ilustran mediante simulación.

13:00h S4.5.4 A low cost drone based multifunction DMR repeater for emergencies

Eduardo Jacob, Juan Jos Unzilla, Jasone Astorga, Maider Huarte
Dpto. de Ingeniera de Comunicaciones, University of the Basque Country UPV/EHU

Abstract: —Nowadays, many emergency communications still rely on Amateur Radio (a.k.a HAM Radio) technologies and volunteers. There are several reasons for this. First, the equipment, frequencies and techniques are well known. Moreover, most of the ham operators own the needed equipment and they are used to move with it and with the additional needed equipment like antennas, batteries and charging devices. But the most important reason is that they do not need third party infrastructures to support both local and long haul communications. Even if most people easily remember ham activity during tornadoes and floods in USA, it is worth noting that in Spain there is also a branch of the the Spanish Amateur Radio Association that deals with communications in emergency situations, EMCOM Spain. This paper presents the architecture of a low cost dronebased multifunction DMR (Digital Mobile Radio) repeater for emergency situations that can be carried either on a captive balloon or on an automated plane (drone) to give support to emergency situations in mountainous areas. The repeater supports also LTE communications. Additionally, the drone carries a reconfigurable system based on a Raspberry Pi Zero W that can be reconfigured on flight to carry different tasks and which is integrated in a Network Function Virtualization (NFV) [1] environment.

13:15h S4.5.5 The Roll of Data Distribution Service in Failure-aware SDN Controllers

Alejandro Llorens-Carrodeguas[1], Cristina Cervelló-Pastor[1], Irian Leyva-Pupo[1], Juan Manuel López-Soler[2], Jorge Navarro-Ortiz[2]
[1]Universitat Politècnica de Catalunya (UPC)
[2]University of Granada (UGR)

Abstract: The necessity of a flexible, scalable, faster and programmable network to offer new services are challenging to telecommunication operators. These characteristics along with robustness and availability are essential in order to guarantee a Quality of Service (QoS) and Quality of Experience (QoE) in the users. Software Defined Networking (SDN) has emerged as a natural solution to this situation as it enables network programmability. The use of Data Distribution Service (DDS) is studied in order to achieve robust and efficient SDN controller federations. In this paper we deploy a 5G scenario with SDN controllers and analyze the roll of DDS to improve the controllers performance. Illustrative results demonstrate an enhanced performance in determining when a controller fails.

13:30h S4.5.6 Flexible services deployment using Small Unmanned Aerial Vehicles for emergency situations

Víctor Sanchez-Aguero[1,2], Borja Nogales[1], Francisco Valera[1], Iván Vidal[1]
[1]Universidad Carlos III de Madrid
[2]IMDEA Networks Institute. Madrid

Abstract: The notorious advances in the Unmanned Aerial Vehicles (UAV) research area is allowing small UAVs (SUAV) to have an increasing presence in different civil applications. In the context of the 5GCity Spanish coordinated project, this paper considers the use of SUAV networks to support emergency services in critical and disaster situations. To solve the set of challenges presented in UAV networks, we present a general use case with the deployment of an NFV and SDN based solution and the different key enabling technologies. The whole deployment will be split into three stages during the project lifetime, with an initial integration using the 5TONIC European Open Research 5G laboratory and then with the different 5GCity project partners.

13:45h S4.5.7 A Framework for Latency-constrained Edge Nodes Placement in 5G Networks

Alejandro Santoyo-González, Cristina Cervelló-Pastor
Department of Network Engineering, Universitat Politècnica de Catalunya (UPC)

Abstract: Latency is a main challenge for most 5G use cases, since mission critical environments are mostly delay sensitive. Edge Computing has become the main technological candidate to overcome this problem. However, under such paradigm edge node placement optimization is mandatory to lower the costs while ensuring ultra-low latency. This paper proposes a framework based on a novel heuristic to tackle the edge node placement problem under 5G delay demands. The in-house heuristic was tested against an exact solution method and a meta-heuristic to validate its applicability.

SESIÓN 4.6: Sesión especial: Comunicaciones por satélite (Parte 2)

JUEVES, 12:15-14:00
Presidentes de sesión: **Miguel A. Salas Natera y Ramón Martínez Rodríguez-Osorio**
Lugar: Seminario 6

12:15h S4.6.1 Comparison between Regular and Irregular Beams of VHTS Satellites in NonUniformed Traffic Scenarios

Flor G. Ortíz[1], Daniel de la Torre[1], Ramón Martínez[1], Miguel Salas[1], Salvador Landeros[2]
[1]Dpto. de Sistemas, Señales y Radiocomunicaciones. Universidad Politécnica de Madrid
[2]Dpto. de Telecomunicaciones. Universidad Nacional Autónoma de México

Abstract: Very High Throughput Satellites (VHTS) are optimized satellite systems that will meet the demands of increasing data traffic demands. VHTS outperforms the capacity of traditional FSS and MSS (Fixed and Mobile Satellite Services, respectively) with contoured regional footprints and aims at achieving 1 Terabit/s per satellite in the near future. The upcoming generation of VHTS (Very High Throughput Satellites) operates based on multispot coverage with intensive frequency and polarization reuse and the use of large bandwidths in the feeder links to provide high capacity satellite links with a reduced cost per Gpbs in orbit. This document presents a comparison between the use of regular beams and irregular beams in terms of performance and the cost of the satellite network.

12:30h S4.6.2 Performance evaluation of High Throughput Satellites (HTS) on suburban scenarios

Luis Ventureira Gómez[1], Ramón Martínez Rodríguez-Osorio[1], Flor de Guadalupe Ortiz Gómez[1], Manuel García Sánchez[2]
[1]Dept. De Señales, Sistemas y Radiocomunicaciones, Universidad Politécnica de Madrid.
[2]Dept. Teoría do Sinal e Comunicacións, Universidade de Vigo.

Abstract: Nowadays the use of satellites for high end communications is growing faster than ever, the measurements and simulations for the new generation are growing in importance. This paper presents the design and implementation of a satellite simulator. The simulations will be done on Ka band, at 38.4 GHz. For the analysis of the link budget where taken into account measurements done in Vigo in a suburban area, having a configuration that resembles an actual satellite link. These measurements will improve the simulator giving actual real results of the losses that occur in suburban scenarios. The importance of this study in not only academic, but also its great value for research, giving real information which can be used on real commercial or academic systems.

12:45h S4.6.3 Optimización del Segmento Terrestre para un Sistema Satelital UHTS mediante Redes Neuronales

Andrés Cornejo[1], Salvador Landeros[1], Ramón Martínez Rodríguez-Osorio[2], José María Matías[1]
[1]Facultad de Ingeniería, Universidad Nacional Autónoma de México
[2]Dpto. de Señales y Sistemas, Universidad Politécnica de Madrid

Abstract: In this work it will be exhibited our research about an Ultra High Throughput Satellite, UHTS, system with 1.0 Tb/s of total capacity per satellite, Multiple Beam Antennas, MBA, in Ka and Q/V bands, and selection of Smart Gateway Diversity, SGD, based on Neural Networks. This system will be able to

cover whole Latin America region. However, the entire system is expected to work without it is being affected by the interference due to the frequency re-use and in some cases, it could be the lack of available spectrum. Therefore, in this article it will show our proposal with results from simulations and evaluations that we have been doing in this last time in order to face the new 5G era by the year 2020 and beyond.

13:00h S4.6.4 Circularly Polarized Active Antenna Array System Calibration for Improved Axial Ratio Performance

Miguel A. Salas-Natera, Ramón Martínez Rodríguez-Osorio, Leandro de Haro, and Manuel Sierra Pérez.
Dept. of Signal, System and Radiocommunications of the Universidad Politécnica de Madrid

Abstract: This paper presents a novel calibration technique for circularly polarized active antenna array with improved axial ratio and polarization-agile systems. The proposed algorithm deals with the problem of calibration of active antenna arrays, proposing a calibration technique that can be implemented in offsite or on-site process depending on the system calibration and control design. The proposed calibration technique starts with the implementation of a complex circular polarization feeding network with the capability to change the response of each of the polarization circuits with signal attenuators. The expansion of equations of the proposed calibration algorithms is also presented. This algorithms deal with the compensation of mutual coupling effect and together with gain, phase and location errors.

13:15h S4.6.5 Quad-Band Inductive Frequency Selective Surface: An application for satellite communications

Juan Andrés Vásquez Peralvo, José Manuel Fernández González
Depto. de Señales, Sistemas y Radiocomunicaciones. Universidad Politécnica de Madrid.

Abstract: An Inductive Frequency Selective Surface (FSS) configured as Gregorian sub-reflector for TV and Radio Satellite Broadcast is presented. The sub-reflector is designed in order to be transparent at 5.925-6.425 GHz L band and 10.7-12.75 GHz Ku band. The sub-reflector parameters were optimized in order to achieve a desired bandwidth as well as stability at different angles of incidence and lowest cross polarization levels in reception and transmission. A parametric study of the unit cell elements is also presented, it gives an insight of their effect on the resonant frequencies. The transmission and reflection parameters are shown in all frequencies of interest in both copolarization and cross-polarization. Finally, the E-Field in the four cases is analyzed, it shows the transmission or reflection effects of the surface while illuminated by a horn antenna. The structure is simulated using CST Microwave Studio.

13:30h S4.6.6 Improvement on Side Lobe Level for Self-Supported Sub-reflector Fed Antenna Systems

Miguel A. Salas-Natera, Ramón Martínez Rodríguez-Osorio, Leandro de Haro and Binoy Noir
Dept. of Signal, System and Radiocommunications of the Universidad Politécnica de Madrid, Ciudad Universitaria, ETSI Telecomunicación, Madrid

Abstract: This work presents significant improvement on Side Lobe Level optimization for self-supported sub-reflector fed systems of compact reflector antennas. The case study presented shows the experimental results of a 1200mm reflector system that operates at Ku band for Satellite Communication

Systems. Besides, de sub-reflector is supported by a radome made of composite material of aramid kevlar and foam. The radome supports an elliptical sub-reflector that illuminates the main reflector with the field fed by a one choke feed horn. The technique used for the reduction of the Side Lobe Level consist on the reduction of the current of the fundamental and first higher mode that are scattered from the main and sub-reflector to the mast and sub-reflector metallic surfaces.

SESIÓN 5.1: Sesión especial: Homenaje al Catedrático Rafael Gómez Martín - Electromagnetismo Computacional y Aplicaciones (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Amelia Rubio Bretones y Mario Fernández Pantoja**
Lugar: Sala Andalucía I

15:30h S5.1.1 Macrobases desacopladas en potencia para el método de los momentos de dispersores dieléctricos

Luis Landesa, Alberto Serna, José M. Taboada
Escuela Politécnica. Universidad de Extremadura

Abstract: We theoretically develop a new set of macrobasis functions for the 3D-dielectrtic method of moments. The main properties of this new macrobases are orthonormal, power decoupled, and, especially, only a few macrobases can model perfect the radiation of the scatter independiently of the incident field.

15:45h S5.1.2 Método de Momentos para estructuras periódicas multicapa con anillos partidos y su aplicación al diseño de reflectarrays con polarización circular

Rafael Florencio Díaz[1], Rafael Rodríguez Boix[2], José A. Encinar Garcinuño[1]
[1]Dpto. de Señales, Sistemas y Radicocomunicaciones, E. T. S. de Ingenieros de Telecomunicación, Universidad Politécnica de Madrid
[2]Dpto. de Electrónica y Electromagnetismo, Facultad de Física, Universidad de Sevilla

Abstract: An efficient software has been implemented for the analysis of the scattering by multilayered periodic structures containing metallic split rings in the unit cell. The software is based on the Method of Moments (MoM) in the spectral domain. Edge singularity basis functions are used in the approximation of the current density on the split rings, which makes it possible a fast convergence of MoM with respect to the number of basis functions. Since the 2-D Fourier transforms of the basis functions cannot be obtained in closed form, judicious tricks are proposed for their efficient computation. The software has been used in the design of circularly polarized reflectarray antennas under the local periodicity assumption. The results obtained have been validated by comparison with results provided by CST. Our software has proven to be between 20 and 600 times faster than CST, the CPU time ratio depending on the required accuracy.

16:00h S5.1.3 Modelo de Circuito para Rejilla de Difracción Plana de Tipo *Echelle*

C. Molero[1], R. Rodríguez-Berral[2], F. Medina[3], F. Mesa[2], M. Memarian[4], T. Itoh[5]

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[2]Dpto. de Física Aplicada I, ETSII, Universidad de Sevilla
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[4]Dpt. of Electrical Engineering, Sharif University of Technology, Tehran, Iran
[5]Dpt. of Electrical Engineering, UCLA, CA, USA

Abstract: In recent years a number of printed blazed gratings have been proposed in the literature. Among these structures there is one that is particularly simple, consisting of an array of printed microstrips. The proper choice of the period and strip widths gives place to the desired blazing phenomenon. The purpose of this contribution is to explain the working principle of this device using simple analytical equivalent circuits whose parameters are obtained using methods previously reported by some of the authors. The use of this model provides a simple interpretation of the observed results and makes the design of the structure straightforward. The analytical predictions are validated by means of comparisons with numerical full-wave simulations using commercial software.

16:15h S5.1.4 A Subcell FDTD Scheme implementation for narrow apertures modeling

Miguel R. Cabello N.[1], Luis D. Angulo[1], Mario F. Pantoja[1], Amelia R. Bretones[1], Rafael G. Martín[1], J. Álvarez[2], Salvador G. García[1]
[1]Dept. of Electromagnetism. Dept. of Electromagnetism University of Granada
[2]AIRBUS, Getafe

Abstract: The finite-difference time-domain (FDTD) method is not able to efficiently model thin features without a drastic reductions of the spatial mesh size, potentially yielding an unfeasible use of memory and CPU requirements. In this manuscript a new electric centered method is proposed for dealing with thin slots in FDTD. A main advantage of this approach resides in its ability to deal with geometries not aligned with the Cartesian grid.

16:30h S5.1.5 Application of advanced simulations in time domain in the EMC certification process of an aircraft

Enrique Pascual Gil, Guadalupe Gutiérrez Gutiérrez, Raúl Molero Castejón
Airbus Defence and Space

Abstract: This document presents an innovative methodology combining simulations and measurements to reduce the cost and time spent during the Electromagnetic Compatibility (EMC) certification process in front of aviation safety authorities of an aircraft. To pass this certification it is necessary to demonstrate the immunity of the aircraft equipment in front of High Intensity Radiated Fields (HIRF) by means of dedicated tests. The use of simulations using a Finite Difference in Time Domain (FDTD) method with a representative electromagnetic model of the aircraft allows reducing the complexity of the test setup by defining much more accurate correction functions to extrapolate from on-ground to in-flight conditions. The hypothesis considered to apply this methodology and its validation are presented.

SESIÓN 5.2: Comunicaciones Móviles e Inalámbricas (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Francisco Falcone Lanas y Ana M. Torres Aranda**
Lugar: Sala Andalucía II

15:30h S5.2.1 Evaluación del rendimiento del servicio de videostreaming adaptativo en redes inalámbricas

Luis Roberto Jiménez, Marta Solera Delgado, Matías Toril Genovés
Dpto. de Ingeniería de Comunicaciones, ETSI Telecomunicación, Universidad de Málaga.

Abstract: YouTube Live is one of the most popular services on the Internet, enabling an easy streaming of a live video with acceptable video quality. Thus, understanding user´s perception of this service is of the utmost importance for network operators. The image Quality delivered and user videoplayback behavior on YouTube Live streaming are important keys to ensure an adequate Quality of Experience (QoE). In this paper, an analytical model, and stacked Bar Graph to estimate the QoE for encrypted YouTube Live service from packet-level data collected in the interfaces of a wireless network is presented. The inputs to the model are Transport Control Protocol (TCP)/Internet Protocol (IP) metrics, from which two Service Key Performance Indicators (S-KPIs) are estimated, namely video quality level (itag) and, videoplayback connection ratio. The model is developed with an experimental platform, consisting of a user terminal agent, a WiFi wireless network, a network-level emulator, a Mitmproxy and a probe software. Model assessment is carried out by comparing S-KPI estimates with measurements from the terminal agent under different network conditions introduced by the network emulator.

15:45h S5.2.2 Herramienta de planificación radio para evaluar la calidad de experiencia en redes móviles

P. A. Sánchez, J. L. Bejarano-Luque, J.F. Cantón, M. Toril, S. Luna-Ramírez.
Dpto. de Ingeniería de Comunicaciones, Universidad de Málaga

Abstract: The use of system-level simulators to estimate the impact of self-planning and self-optimization algorithms is a common practice for cellular operators. In this paper, a modification of a static Long Term Evolution (LTE) simulator is proposed to estimate the Quality of Experience (QoE) provided in each location on a per-service basis. The core of the simulator is the estimation of radio connection throughput based on radio connection traces. For this purpose, an analytical performance model for the scheduling process in a multi-service scenario is developed. The tool is validated with a real trace dataset taken from a live LTE network.

16:00h S5.2.3 Marco funcional para la gestión de slicing en la red de acceso radio 5G

R. Ferrús, O. Sallent, J. Pérez-Romero
Departamento de Teoría de la Señal y Comunicaciones, Universidad Politécnica de Cataluña

Abstract: El soporte de slicing en los futuros sistemas 5G persigue acomodar, en una misma infraestructura de red, una diversidad de aplicaciones y modelos de negocio mucho mayor que el permitido actualmente con los sistemas 4G. Si bien el soporte de slicing a nivel funcional y de procedimientos ya ha sido cubierto en la primera entrega de especificaciones 5G, el desarrollo de

soluciones para la gestión de las capacidades de slicing, particularmente en lo que concierne a la red de acceso 5G, se encuentra en una fase mucho más incipiente. En este contexto, esta comunicación presenta un marco funcional para la gestión de slicing en la red de acceso radio y proporciona un conjunto de ejemplos de la operativa de dicho marco funcional en un escenario ilustrativo.

16:15h S5.2.4 Optimización de la QoE de un servicio de vídeo streaming en un entorno celular

J. Mendoza, A. Herrera, D. Palacios, I. de-la-Bandera y R. Barco
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: The rising traffic demand in mobile communications networks, as well as the increase in the number of available services and the expectations of users have led operators to seek new techniques to optimize mobile networks. In this way, traditional optimization techniques, based on improving the quality of service offered to users, have given way to new techniques based on improving the quality of experience (QoE) perceived by users. In this work, a study to improve the QoE perceived by the users in a real time video streaming service from the optimization of the transmission buffer size of the RLC (Radio Link Control) layer is presented. The optimization, which has been carried out in a simulated cellular environment, has been performed for two different system bandwidth values, thus proving the relationship between the quality perceived by the users, the optimal buffer size and the available bandwidth.

16:30h S5.2.5 Sistema de Localización de Dispositivos Android basado en Redes GSM

Luis Alberto Martínez Hernández[1], Sandra Pérez Arteaga[1] , Linda Karina Toscano Medina[1] , Gabriel Sánchez Pérez[1] , Ana Lucila Sandoval Orozco[2]
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[2]Grupo de Análisis, Seguridad y Sistemas (GASS) Departamento de Ingeniería del Software e Inteligencia Artificial (DISIA) Facultad de Informática, Universidad Complutense de Madrid (UCM)

Abstract: With the new applications that can be given to the positioning technologies in Android mobile devices, there are a large number of solutions that base their main functions on the precision of the technologies used. At first the GSM service was simply a means of transmitting voice and short messages, with the passage of time the technologies were evolving and expanding their characteristics. When an emergency happens, these technologies collapse due to the high concentration of mobile subscribers in a single place which exceeds the capacity of subscribers that an antenna can support. This causes that the calls directed to the emergency services are not completed making it difficult to rescue the people in emergency. Although GSM is not a technology dedicated to positioning, it can provide valuable data for localization with dedicated algorithms.

16:45h S5.2.6 Un nuevo criterio basado en calidad de experiencia para el balance de carga en redes LTE

C. Gijón, S. Luna-Ramírez, M. Toril
Dpto. de Ingeniería de Comunicaciones, ETSI Telecomunicación, Universidad de Málaga

Abstract: The increase in traffic and services in mobile networks has made network management a very complex task. This fact has motivated the development of many algorithms in a SelfOrganized Network

(SON) framework, such as Mobility Load Balancing (MLB). MLB achieves to solve congestion problems by sharing traffic demand among neighbour cells through the modification of handover parameters. However, it presents some limitations in current LTE networks. These limitations have a negative impact on end-user throughput and thus in Quality of Experience (QoE) perceived by end-users. In this paper, a sensitivity analysis of throughput according to Handover (HO) margins is presented and an alternative indicator for tuning HO margins is introduced, focusing on enduser throughput. The assessment is carried out in a trial LTE network. Results show that the proposed indicator improves network performance in terms of end-user throughput from that obtained with classical MLB algorithms.

17:00h S5.2.7 Simulador de 5G a partir del generador de canal QuaDRiGa

Francisco Jesús Quero de la Rosa, Pablo Muñoz Luengo, Juan Francisco Valenzuela Valdés
Departamento de Teoría de la Señal, Telemática y Comunicaciones, Universidad de Granada - CITIC.

Abstract: With the aim of satisfying the stringent requirements of the new emerging technologies and facilitating their planning and deployment, numerous initiatives have been taken from the industry and academia sectors. One of them is QuaDRiGa, a simulation-tool currently used in several European projects to generate realistic radio channel impulse responses which are compatible with 3rd Generation Partnership Project, 3GPP standardized channel models. This paper extends QuaDRiGa to produce network-level simulations of relevant 5G scenarios in a computationally-efficient manner. In addition, performance evaluations in terms of capacity and coverage are provided for realistic use cases.

SESIÓN 5.3: Sesión especial: In memoriam Prof. Dr. Mariano Barba Gea

JUEVES, 15:30-17:15
Presidentes de sesión: **José Antonio Encinar Garcinuño y Eduardo Carrasco Yépez**
Lugar: Sala Andalucía III

15:30h S5.3.1 Antenas tipo reflectarray con control electrónico del haz mediante diodos PIN y conmutadores MEMS: contribuciones de Mariano Barba Gea

Eduardo Carrasco, José A. Encinar
Information, Processing and Telecommunications Center, Universidad Politécnica de Madrid, ETSI Telecomunicación

Abstract: This contribution has been written as a tribute to our friend and colleague Mariano Barba Gea, who passed away on July 20th, 2017. Thanks to his engineering skills and scientific curiosity, Mariano was a key player in the development of reflectarray antennas with electronic control. The manuscript summarizes two technologies that have been used to dynamically reconfigure the beam in reflectarray antennas: PIN diodes and micro-electromechanical systems (MEMS). In both cases the reflectarray element consisted of patches aperture coupled to delay lines in a gathered configuration. An X-band reflectarray with switching beam using PIN diodes is presented, including measurements in anechoic chamber, as well as cells with both PIN diodes and MEMS that have been experimentally validated with the waveguide simulator method.

15:45h S5.3.2 Contribución de Mariano Barba Gea al diseño y prototipado de antenas reflectarray

José A. Encinar[1], Manuel Arrebola[2], Eduardo Carrasco[1], Gerardo Pérez-Palomino[1]
[1]Information, Processing and Telecommunications Center, Universidad Politécnica de Madrid, ETSI Telecomunicación
[2]Dpto. Ingeniería Eléctrica, Electrónica, de Computadores y Sistemas, Universidad de Oviedo

Abstract: This contribution is dedicated to our beloved friend and colleague in the Grupo de Electromagnetismo Aplicado at Universidad Politécnica de Madrid, the late Prof. Mariano Barba, who actively supported the team with his brilliant professional skills. The paper contains a brief introduction to the professional carrier of Professor Mariano Barba and an example of his main contributions to the design, development and prototyping of new technologies in reflectarray antennas. In particular, a detailed description is presented for a reflectarray antenna operating in dual-frequency and dual polarization, with applications to satellite communications in Ka-band.

16:00h S5.3.3 Diseño de un Combinador Radial de Potencia de 16 Vías en Banda Ku mediante el Modo Circular TE_{01}

José R. Montejo-Garai[1], Irene O. Saracho-Pantoja[1], Jorge A. Ruiz-Cruz[2], Jesús M. Rebollar.
[1]Grupo de Electromagnetismo Aplicado, Information Processing and Telecommunications Center, Universidad Politécnica de Madrid
[2]Escuela Politécnica Superior, Universidad Autónoma de Madrid

Abstract: This work presents a 16-way Ku-band radial power combiner using the very low loss TE_{01} circular waveguide mode. The accomplished design shows an excellent performance: the experimental prototype has a return loss better than 30 dB, with a balance for the amplitudes of (±0.15 dB) and (±2.5º) for the phases, in a 16.7% fractional bandwidth (2 GHz centered at 12 GHz). For obtaining these outstanding specifications, a rigorous step-by-step procedure is presented. Firstly, a high-purity mode transducer has been designed from the TE_{10} mode in the rectangular waveguide to the TE_{01} mode in the circular waveguide, with very high attenuation (> 50 dB) for the other propagating and evanescent modes. Secondly, an E-plane 16way radial power divider has been designed. Finally, both the transducer and the divider have been assembled to make the radial combiner. The prototype has been carefully manufactured, showing a very good agreement between the measurements and the full-wave simulations.

16:15h S5.3.4 Diseño de un Filtro Comb-Line en el Taller de Sistemas de Comunicaciones

Ana Buesa-Zubiria
TRYO Aerospace, Carretera Campo Real, km 2,100, 28500, Arganda del Rey, Madrid. Previamente en Dpto. Señales, Sistemas y Radiocomunicaciones. Universidad Politécnica de Madrid. ETSI Telecomunicación

Abstract: This communication contains a brief description of a design made in one of Mariano Barba's subjects: Communications Systems Workshop. The main objective was to put into practice the student knowledge of communication systems acquired throughout his degree studies. In the 2016/2017 academic year, the design theme was to create an Automatic Dependent Surveillance-Broadcast (ADS-B) receiver. First of all, a system level design was made to establish the electric specifications of each receiver device. Then, a distribution of the work between the students was done. In Prof. Barba's own words "Let us be practical and engineers… We have to make it work, and we will have to use it".

16:30h S5.3.5 Technological Developments for a Space-borne Orbital Debris Radar at 94 GHz

Marta Ferreras[1], Mario Ramírez-Torres[1], Clara Hernández[1], Carlos García-de-la-Cueva[1], Mariano Barba[1], Gerardo Pérez-Palomino[1], José A. Encinar[1], Manuel Sierra-Castañer[1], Jesús Grajal[1], José-Luis Vázquez-Roy[2] and Eva Rajo-Iglesias[2]
[1]Information Processing and Telecommunications Center, Universidad Politécnica de Madrid
[2]Department of Signal Theory and Communications, Universidad Carlos III de Madrid

Abstract: This paper describes the design and some technological developments for a 94-GHz heterodyne chirp radar prototype for space debris detection. We use off-the-shelf components for both the signal generation and the acquisition subsystems, and W-band GaN solid-state technology for the high-power Tx/Rx modules. Several radiating structures are considered to expand the system for monopulse and electronic beamsteering.

16:45h S5.3.6 Contribución de Mariano Barba Gea al Diseño y Validación de Reflectarrays Reconfigurables basados en Cristal Líquido

Gerardo Pérez-Palomino[1], Xabi Quintana[2], Eduardo Carrasco[1], Morten. A Geday[2], José. A Encinar[1]
[1]Centro de Investigación en Procesado de la Información y Telecomunicaciones, Universidad Politécnica de Madrid
[2]Grupo de Fotónica Aplicada, Departamento de Tecnología Fotónica, Universidad Politécnica de Madrid

Abstract: This paper summarizes some contributions of Professor Mariano Barba, into the framework of collaborations with researchers of different groups, to the modelling, characterization, design and experimental validation of reflectarray antennas based on Liquid Crystal technology (LC) for electronic beam scanning. This innovative technology is especially interesting in applications working beyond 60 GHz.

SESIÓN 5.4: Sesión especial: Técnicas y tecnologías de fabricación para dispositivos en RF

JUEVES, 15:30-17:15
Presidentes de sesión: **Eva Rajo Iglesias y Alejandro Valero Nogueira**
Lugar: Seminario 1+2

15:30h S5.4.1 3D printed Horn Antenna for Space and Telecommunications

Jorge Teniente-Vallinas[1,2], Juan Carlos Iriarte-Galarregui[1,2], Rubén Caballero-Nagore[2,3], Daniel Valcazar-Berdofe[3], Mikel Goñi-Esparza[3] and Aitor Martínez-Agoües[3]
[1]Institute of Smart Cities (ISC). Public University of Navarra
[2]Electrical and Electronic Engineering Department. Public University of Navarra
[3]ANTERAL S.L, I+D building "Jerónimo de Ayanz", Public University of Navarra

Abstract: In this work, a study of the performance of an antenna, manufactured with an extremely precise stereolithography 3D printer and a resin for maximum accuracy and detail, is being carried. Electroless

plating of the components to cover the piece with a thick copper layer to improve its mechanical resistance has been made. A detailed study of a spline horn antenna performance is being covered. Its measured results are compared with its metallic lathe manufactured version. Some conclusions are derived from this testing so as to improve additive manufactured antennas for space applications in future versions.

15:45h S5.4.2 Corrección de errores en la fabricación de dispositivos en guía vacía integrada en substrato (ESIW) y línea coaxial vacía integrada en substrato (ESICL)

Juan Ángel Martínez[1], Ángel Belenguer[1], Alejandro L. Borja[1], Héctor Esteban[2], y Vicente E. Boria[2]
[1]Departamento de Ingeniera Eléctrica, Electrónica, Automática y Comunicaciones, Universidad de Castilla-La Mancha, Escuela Politécnica de Cuenca
[2]Instituto de Telecomunicaciones y Aplicaciones Multimedia, Universitat Politècnica de València

Abstract: Empty substrate integrated transmission lines are a promising technology for implementing high performance and high frequency communication devices. They improve the performance of substrate integrated waveguides by removing the lossy dielectric substrate, while maintaining the low profile, low cost and easy manufacturing characteristics. In our research group we have developed two of these new empty substrate integrated transmission lines, the ESIW and the ESICL, which have the advantage that the lateral walls are continuous rather than rows of metallized vias as in other solutions. Therefore there is no dielectric inside the guide, and the simulation and design is easy and fast. However, in order to obtain accurate results some typical errors produced by the manufacturing process have to be corrected. In this work these errors are detailed, their effects are assessed, and the procedure to correct them is explained.

16:00h S5.4.3 Diseño de Componentes en Guía de Onda para Banda W mediante Tecnología de Foto Resina SU-8

Carlos A. Leal-Sevillano[1*], Yingtao Tian[2], Michael J. Lancaster[2] Jorge A. Ruiz Cruz[3], José R. Montejo Garai[1], Jesús M. Rebollar[1]
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[2]Department of Electrical, Electronic and Computer Engineering, University of Birmingham Edgbaston, Birmingham B15 2TT, Reino Unido
[3]Escuela Politécnica Superior, Universidad Autónoma de Madrid

Abstract: This contribution addresses the design of waveguide components by means of stacked micro-machined layers in photo-resist SU8. This process provides an alternative mean for building components in waveguide technology at high frequency bands, as the designs in W-band of this paper. An ortho-mode transducer (OMT) for dual linear polarization is presented along with the results of a filter for W-band applications. The proposed designs are optimized taking into account the geometric restrictions involved in the manufacturing of the micromachined layers and avoiding the use of small features. Moreover, the number of equal-thickness layers required for the devices is reduced as much as possible, in order to simplify the SU8 manufacturing. The experimental results obtained for the OMT and the filter will be shown in the presentation, making this technology a suitable candidate for manufacturing waveguide devices at W-band.

16:15h S5.4.4 Fabricación por Diffusion Bonding de Agrupaciones de Antenas en Guía de Onda para Banda W

E. García-Marín, J.L. Masa-Campos, P. Sánchez-Olivares
Dpto. de Tecnología Electrónica y de las Comunicaciones, Universidad Autónoma de Madrid

Abstract: Millimeter-wave radiating systems appear attractive for radiofrequency applications like radio-positioning or telecommunications. High-gain array antennas can be implemented in reduced-size devices in this part of the frequency spectrum. Waveguide implementations seem indispensable to mitigate the dissipation losses inherent to these frequencies. Nevertheless, the implementation of multilayer waveguide array antennas is a challenge. Electrical contact between the antenna layers must be guaranteed to prevent power leakage, which is ensured only in part with mechanical tightening. Additive manufactured antenna arrays provide electrical continuity, although dimensional accuracy diminishes and dissipation losses increase owing to surface roughness and reduced conductivity. In this context, diffusion bonding allows complex multilayer designs by joining accurately-etched metallic sheets without additional sticking or tightening material. A corporate-fed waveguide antenna array is presented in this paper to experimentally validate this manufacturing technique for W-band implementations.

16:30h S5.4.5 Micromachining of High Frequency Components at ISC/UPNA

Jorge Teniente-Vallinas[1,2], Rubén Caballero-Nagore[2,3], José Manuel Pérez-Escudero[2], Alicia Torres-García[2], Javier Chocarro Álvarez[2], Adrián Gómez-Torrent[4]
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[2]Electric, Electronic and Communication Engineering Department, Public University of Navarra
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[4]Department of Micro and Nanosystems, KTH Royal Institute of Technology, Stockholm, Sweden

Abstract: Manufacture of components at high frequencies (submm wave and THz) is known to be extremely difficult. Essential components such as antennas, ortho-mode transducers (OMT), filters, and others for high performance system development are too difficult to fabricate with traditional machining techniques or even impossible to build. Micromachining of silicon wafers coated with evaporated copper and gold can be an alternative to fabricate these components. In this paper, wet and dry etching techniques available at the ISO7 clean room of the Institute of Smart Cities (ISC) at the Public University of Navarra are being explained.

16:45h S5.4.6 Técnicas de Fabricación Avanzadas en Tecnología LTCC para Aplicaciones de Microondas y Onda Milimétrica

Mariano Baquero Escudero[1], Jorge Daniel Martínez Pérez[2]
[1]Dpto. de Comunicaciones
[2]Dpto. de Ingeniería Electrónica. Universitat Politècnica de Valencia

Abstract: In this paper, some manufacturing techniques recently developed at the LCAF (High Frequency Circuits Laboratory) facilities of the Universitat Politècnica de València (UPV) are presented. In particular, the implementation of empty cavities embedded into the ceramic substrate and the manufacturing of fine lines using photolithograpy are discussed. Results of both techniques are shown, and the advantages and limitations clearly identified, focusing on their potential application to microwave and mm-wave circuits.

17:00h S5.4.7 Técnicas de fabricación aditiva aplicadas al diseño de circuitos planares de radiofrecuencia

Héctor García Martínez[1], Ernesto Ávila Navarro[1], Germán Torregrosa Penalva[2]
[1]Área de Tecnología Electrónica, Universidad Miguel Hernández de Elche
[2]Área de Teoría de la Señal, Universidad Miguel Hernández de Elche

Abstract: This article presents the design and manufacture of microwave planar devices using additive techniques. The substrate design process, based on a low cost 3D printer and standard filament with different additive options, is described. The designed substrates have been characterized in order to obtain their dielectric properties in the range of 0.1 GHz to 4 GHz. Finally, to check the possibility of using the manufactured substrates, two stepped impedance filters have been designed in the RF range. Some of the possibilities offered by the additive techniques in the substrates design have been used. The designed filters have been simulated and measured with good results, which demonstrates the possibility of using low cost 3D printers in the RF circuit design process.

SESIÓN 5.5: Sesión especial: Ongoing research towards 5G (Parte 2)

JUEVES, 15:30-17:15
Presidentes de sesión: **Jorge Navarro Ortíz y David Rincón Rivera**
Lugar: Seminario 3+4

15:30h S5.5.1 Fully Synchronous SDN (FSS): Towards Synchronization-as-a-Service in 5G Networks

Raúl Suárez, David Rincón, Anna Agustí, Sebastià Sallent
Dept. of Network Engineering, Universitat Politècnica de Catalunya (UPC)

Abstract: Many modern telecommunications systems rely on strict timing and synchronization requirements. Synchronous Ethernet (SyncE) and Precision Time Protocol (PTP) are widely used to provide frequency and phase synchronization in current 4G and future 5G backhaul and core networks. This paper describes how the synchronization capabilities provided by these two technologies can be managed as a service following the SDN/NFV paradigm, thus opening the way for a virtualized syncronization control plane in 5G core and access networks.

15:45h S5.5.2 New Radiofrequency Technologies for 5G Systems

M. Sierra Castañer[1], R. Martínez Rodríguez-Osorio[1], M. García Sánchez[2], C. Briso Rodríguez[3], Juan Moreno[3], M. Gómez Laso[4], I. Arnedo[4], J.L. Masa Campos[5], A. Tamayo Domínguez[1], M. Sierra Pérez[1], B. Galocha Iragüen[1], J.M. Fernández González[1], M. Calvo Ramón[1], J.L. Besada Sanmartín[1], J.L. Fernández Jambrina[1], M. Vera Isasa[2], I. Cuiñas Gómez[2], A. Vázquez Alejos[2], E. Lemos Cid[2], E. García Marín[5]
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[2]Universidade de Vigo
[3]ETSI de Sistemas de Telecomunicación. Universidad Politécnica de Madrid.

[4]Universidad Pública de Navarra
[5]Universidad Autónoma de Madrid

Abstract: This paper shows the results of the research project "Enabling Innovative Radio Technologies for 5G networks", integrated 5 research groups belonging to 4 different universities. The aim of this project is the design new radiofrequency technologies, including transmission line architectures, antennas, filters, and components. Also, the project looked for different application scenarios and the impact in the system level. Another important task is the analysis and measurement of propagation effects in frequency bands up to 60 GHz in these scenarios.

16:00h S5.5.3 P4ON: A 5G-Aware P4-Based PON Architecture

Adebanjo Haastrup, David Rincón, Hamzeh Khalili, Sebastià Sallent
Dept. of Network Engineering, Universitat Politècnica de Catalunya (UPC)

Abstract: 5G promises to deliver higher rates with lower latency and fixed-mobile network convergence. Passive Optical Networks (PON) have emerged as a viable option for 5G access and backhaul networks due to their cost effectiveness and high bandwidth. Improving the flexibility of network management is a key requirement of 5G, and Software Defined Networking (SDN), due to network programmability capabilities, is considered a key component of 5G. However, OpenFlow (OF), the current southbound SDN interface, has several limitations. P4 is a new language for Programming Protocol-Independent Packet Processors that promises to overcome OF's limitations and brings in more flexibility for controlling the data plane of SDN devices. This paper presents a P4-based SDN architecture for PONs, by building a PON headend around a programmable P4 switch.

16:15h S5.5.4 SDN-based Management of Time-Sensitive Networks in 5G Fronthaul

Feliu Castaño, Oriol Castaño, Gabriel Anangonó, David Rincón, Anna Agustí
Dept. of Network Engineering, Universitat Politècnica de Catalunya (UPC)

Abstract: Software Defined Networking is a key element in the 5G architecture, as it allows a more flexible, dynamic network management. Cloud RAN is another enabler of 5G, due to the expected increased based station density in the fronthaul. In Cloud RAN deployments the I/Q signals are transported in the CPRI format over access networks, thus requiring QoS guarantees regarding loss, bandwidth and latency. Time Sensitive Networking (TSN) is a new technology that introduces synchronous capabilities in Ethernet networks, and is one of the most promising technologies for 5G fronthaul and backhaul. Therefore, the SDN-based management of TSN is an important topic, in order to coordinate the fronthaul, backhaul and core 5G networks. The IEEE 802.1Qcc and 802.1CM working groups are currently standardizing the SDN management of TSN and the use of TSN in the fronthaul. This paper describes the architecture and state of the standards, and presents a design and implementation status of a TSN SDN-based controller.

16:30h S5.5.5 A Framework for Placement and Optimization of Network Functions in 5G

Irian Leyva-Pupo, Cristina Cervelló-Pastor, Alejandro Llorens-Carrodeguas
Department of Network Engineering, Universitat Politècnica de Catalunya (UPC)

Abstract: In this paper, we propose an architecture for the 5G core network using Software Defined Networks (SDN) and Network Functions Virtualization (NFV) technologies. Moreover, based on this architecture, we design a framework for determining the Network Functions (NFs) placement and optimizing the NFV Infrastructure (VNFI) resources and network response time during emergency situations. This framework is based on a twostage method. In the first stage of the method, the placement of the SDN Controllers and Virtual Network Functions (VNFs) is determined considering not only latency requirements and load levels but also users mobility and network functions type. Meanwhile, in the second stage, the NFVI resources are dynamically optimized according to variations on network conditions.

SESIÓN 5.6: Sesión especial: Tecnologías en Milimétricas y Terahercios para Comunicaciones y Sensorización

JUEVES, 15:30-17:15
Presidentes de sesión: **José María Molina García-Pardo y Lluis Jofre Roca**
Lugar: Seminario 6

15:30h S5.6.1 Full-vector analytical coupling model of mm-wave whispering-gallery resonances in sphere

Gabriel Santamaría-Botello, Kerlos A. Abdalmalak, Alejandro Rivera-Lavado, Daniel Segovia-Vargas, Luis Enrique García Muñoz
Deptartamento de Teoría de la Señal y Comunicaciones. Universidad Carlos III de Madrid

Abstract: We present an analytical theory for the coupling from a dielectric rod waveguide into a dielectric sphere. For this, coupled mode theory is used taking into account the vector nature of the modes propagating in the waveguide and excited in the resonator. A validation experiment is carried out where a gallium arsenide rod waveguide couples to a sapphire sphere, exciting whispering-gallery modes at frequencies ranging from 75 GHz up to 110 GHz. The experiment shows good agreement with the theory. The analytical model is useful for optimizing the coupling to whispering-gallery cavities, with applications in mm-wave devices including filters, oscillators and photonic upconverters.

15:45h S5.6.2 W-band Near-Field Vehicle Synthetic Aperture Radar Imaging for Urban Environments

Martín Trullenque[1], María-Teresa Martínez-Inglés[2], Christian Ballesteros[1], Andreas Pfadler[1], Jordi Romeu[1], José-María Molina-García-Pardo[3], Antonio Mateo Aroca[3] y Lluís Jofre[1]
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[2]Centro Universitario de la Defensa. Base Aérea de San Javier. Academia General del aire, Cartagena.
[3]Universidad Politécnica de Cartagena, Dpto. Tecnologías de la Información y las Comunicaciones.

Abstract: There is a growing need to equip the new vehicle with new radar sensing devices able to visualize the environment into a clear and robust way with respect to other forms of sensing. New W-band radar systems offer a unique capability of delivering information into a reliable and quite precise way. In

this paper we investigate, both analytically and experimentally, the capability, in terms of resolution and accuracy, of these radar systems to reconstruct a set of canonical cylindrical targets for two different imaging geometries, the circular (frontal o posterior) and the linear (lateral).

16:00h S5.6.3 Theoretical and Experimental Study at 60 and 94 GHz in Indoor Environments

María-Teresa Martínez-Inglés[2], Davy Gaillot[1], Juan Pascual García[3], José-María Molina-García-Pardo[3] and José-Víctor Rodríguez[3], Leandro Juan Llácer[3], Miguel Ferrando[4]
[1]Foundation For Biomedical Research of Principe de Asturias Hospital
[2]The University Center of Defense, San Javier Air Force Base, Ministerio de Defensa-Universidad Politécnica de Cartagena, Santiago de la Ribera 30720, Spain,
[3]Information Technologies and Communications Department, Universidad Politécnica de Cartagena, Cartagena 30202, Spain Universidad Politécnica de Valencia

Abstract: This work presents an extensive multidimensional analysis of Line-of-Sight experimental data and simulations at two frequency bands: 60 GHz and 94 GHz. MIMO channel transfer functions were obtained with a ray tracing engine that includes single-order diffuse scattering. The received power, RMS delay spread, maximum excess delay and clustering is computed from both measured and simulated data indicate that diffuse scattering improves ray tracing based modeling. The analysis of the results shows that even a raw description of the environment can be used to predict mmW propagation with ray tracing.

16:15h S5.6.4 440 GHz fabrication of a Slotted-Waveguide Antenna based on Gap Waveguide Technology

Rubén Caballero-Nagore[2,3], Jorge Teniente-Vallinas[1,2], Miguel Ferrando-Rocher[4] and Alejandro Valero-Nogueira[4]
[1]Institute of Smart Cities (ISC). Public University of Navarra
[2]Electrical and Electronic Engineering Department. Public University of Navarra
[3]ANTERAL S.L, I+D building "Jerónimo de Ayanz", Public University of Navarra
[4]iTeam Institute. Universitat Politècnica de València

Abstract: A 440 GHz 4x4 slotted-waveguide Antenna fabrication procedure is presented in this paper. The antenna feeding network is based in Groove Gap Waveguide (GGW) technology. The fabrication is intended to be done with Deep Reactive Ion Etching (DRIE) Bosch process in Silicon for the GGW feeding network and Wet Etching also in Silicon for the slots. The resultant slots are in fact tapered apertures with a fixed 54.7º taper angle. The antenna topology is selected to reduce propagation losses inherent to sub-millimetre wave frequencies and the fabrication procedure takes advantage of the silicon etching capabilities we have at Public University of Navarra ISO 7 clean room facility. Wet etching of the 4x4 slot array is selected so as to avoid extremely thin silicon top layer that could bend and ruin alignment efforts. These tapered slots aperture has in fact improved gain and matching of the whole antenna. Also, the GGW feeding network has been redesigned to simplify DRIE manufacturing so as to include only two different etch depths.

16:30h S5.6.5 Terahertz detection using strained silicon FET: Front and back illumination

J. Delgado Notario[1], J.E. Velázquez[1], J.Calvo[1], Miguel Ferrando Bataller[2], K. Fobelets[3] and Y.M. Meziani[1]

[1]NanoLab, Universidad de Salamanca.
[2]Dpto. de Comunicaciones. Universitat Politécnica de Valéncia, Escuela Técnica Superior de Ingenieros de Telecomunicación.
[3]Department of Electrical and Electronic Engineering, Imperial College, London, Imperial College London, South Kensington Campus, London, UK.

Abstract: Strained Silicon Modulation Field Effect Transistors (MODFET) were excited at room temperature by terahertz radiation at frequencies of 0.15 and 0.3 THz. Two configurations were investigated: (i) front side, where the device was excited from the top through the bonding wires and (ii) from the back side where the radiation reached directly the channel through the different layers of the structure. Clear evidence of the coupling of terahertz radiation by the bonding wires was demonstrated under excitation of 0.15 THz. Under excitation at 0.3 THz both photoresponse signals obtained from front and back illumination conditions were in good agreement.

16:45h S5.6.6 Medición de materiales con radiación THz

Andrés Felipe Escobar Mejía[1,2], Juan Pablo Ciafardini[2], José Alberto Bava[1,2], Jorge O. Tocho[1]
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[2]Dpto. Electrotecnia, Fac. de Ingeniería. Universidad Nacional de La Plata, La Plata

Abstract: This paper presents the experimental measurement of different materials when are irradiated by terahertz radiation (THz), applying THz spectroscopy techniques in the time domain. The radiation is emitted by a photoconductive antenna, excited by a femtosecond laser. The results are obtained when measuring the THz pulse transmitted through the materials when implementing coherent and incoherent detection systems.

SESIÓN 6.1: Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 1)

VIERNES, 9:15-10:30
Presidentes de sesión: **Sonia Mota Fernández y Luz García Martínez**
Lugar: Sala Andalucía I

9:15h S6.1.1 Extracción y clasificación de características a partir de señales EEG

Francisco Laport, Paula M. Castro, Francisco J. Vázquez-Araujo, Adriana Dapena, José J. Lamas-Seco
Dpto. de Ingeniería de Computadores. Universidade da Coruña Facultade de Informática

Abstract: In this article, we make a comparison of performance between methods for extraction and classification of EEG signals. For feature extraction we consider several methods already proposed in previous works based on instantaneous values of registered data using moving overlapping windows. As an alternative to these methods, we propose the use of averaged instead of instantaneous values. For signal classification, we will implement the algorithms known as Linear Discriminant Analysis, Neural Networks and Support Vector Machine. As a result, we can say that

our proposal based on averaged data combined with Linear Discriminant Analysis clearly improves the classification results achieved with other methods.

9:30h S6.1.2 LitterDrone: monitorización de basura marina empleando drones y análisis de imagen

Fernando Martín-Rodríguez, Laura Rodríguez-Barreiro, Marta Fernández-Bastos, Gema Martínez Iglesias
Dpto. de Teoría de la Señal y Comunicaciones. Universidad de Vigo

Abstract: This communication is about "LitterDrone" project. LitterDrone is funded via the Blue-Labs program of the European commission and it aims to make a contribution to solve the problem of marine litter. Part of this problem is monitoring stranded marine litter on beaches (measuring number and type of litter elements). Monitoring results can be used to infer data on litter origin and on the influence of tides, currents and human activity. OSPAR convention [1] is a joint European initiative that tries to unify forces against marine pollution. Part of this convention implies that contracting parties (countries) must monitor periodically stranded marine litter on beaches. Spain has signed the convention in January 1994. Litter monitoring in Spain is nowadays implemented by human personnel counting (& picking) litter items in certain beaches at certain times (4 campaigns each year, one for each season). LitterDrone project aims to create a new and/or complementary methodology based on obtaining images from drone flights (creating orthomosaics of RGB and multiespectral images) and developing software to analyze such images to obtain results comparable to those of the manual sampling.

9:45h S6.1.3 An advanced mixed-signal processing platform with high performance SoCs

Pablo Garrido-Sánchez, José Carlos Martínez-Durillo, Andrés Roldán Aranda
Dept. of Electronics and Computer Technology. University of Granada.

Abstract: This work describes a general-purpose mixed signal audio processing architecture. This processing environment focuses on controlling acoustic emission while aiming at being as flexible as possible. This way, the platform is able to acquire a fully differential audio signal, perform digital or analog audio analysis and processing, and drive it again through professional audio analog interfaces. While the signal processing is being done, a sensor set provides the processing core real-time information about environmental variables that may be interesting during the signal conditioning. In this paper, integrated devices are compared and analyzed in terms of audio figures of merit. This comparison results in an optimal set of integrated circuits (IC) that provides the architecture with an implementable solution. Basic acoustic noise emission controlling algorithms and use cases are shown at the end of this document. Proposed digital subsystems are based on cutting-edge SoCs. By doing so, digital system interconnection, acoustic data transmission to storage and analysis systems or compatibility with future upgrades will be plausible.

10:00h S6.1.4 Classifying volcano-seismic signals: a comparative study based on deep learning approaches

Manuel Titos[1], Ángel Bueno[1], Luz García[1], Isaac Álvarez[1] , Carmen Benítez[1], Jesús Ibáñez[2]
[1]Department of Signal Theory, Telematic and Communications, University of Granada.
[2]Instituto Andaluz Geofísica, University of Granada.

Abstract: This work proposes the use of Deep Neural Networks for automatic classification of isolated volcano-seismic events. Available databases in the field of volcanic seismology have two main singularities compared to traditional dabatabases used in Deep Learning: they have a small size imposed by the lack of labelled data, and events (1-D seismic signals registered by seismographs) do not have a common size. These singularities make necessary a primary parameterization to feed the models under analysis. Once signals have been parameterized, Deep Belief Networks (DBNs) and Stacked Autoencoders (sDAs) have been implemented and evaluated over a dataset of seven classes of volcano-seismic events from the Volcán de Fuego in Colima, Mexico. Different configurations and number of hidden layers have been compared to the classical Multilayer Perceptron (MLP). Deep architectures outperform MLP with better results and lower per-class cross-entropy, opening a field of study for automatic recognition of volcano-seismic events.

10:15h S6.1.5 Influencia del Modelado de Obstáculos en la Difracción Múltiple de Ondas Acústicas

Domingo Pardo Quiles[1], Rubén Lozano Giménez[1], José-Víctor Rodríguez[1], Leandro Juan-Llácer[1] y María-Teresa Martínez-Inglés[2]
[1]Dpto. de Tecnologías de la Información y las Comunicaciones. Universidad Politécnica de Cartagena
[2]Centro Universitario de la Defensa. Base Aérea de San Javier. Academia General del Aire. Ministerio de Defensa-Universidad Politécnica de Cartagena

Abstract: A uniform theory of diffraction (UTD)-based formulation for the analysis of the multiple diffraction of sound when the diffracting obstacles are equispaced and modeled as rectangular sections is hereby presented. In this sense, the insertion losses results achieved by such theoretical model are properly compared with those obtained with a formulation already published by the authors which assumes the obstacles modeled as knife-edges or wedges. This way, an analysis of the impact of obstacle modeling on sound attenuation caused by diffraction is carried out, thus contributing to the obtaining of more precise acoustic propagation models when multiple diffraction caused by equi-spaced objects of rectangular shape has to be taken into account, as occurs with the typical audience seating of a concert hall.

SESIÓN 6.2: Componentes y Circuitos Pasivos de Microondas (Parte 1)

VIERNES, 9:15-10:30
Presidentes de sesión: **José Ramón Montejo Garai y Rafael Rodríguez Boix**
Lugar: Sala Andalucía II

9:15h S6.2.1 Power Divider and 90º Hybrid Directional Coupler in Empty Substrate Integrated Coaxial Line

José M. Merello, Vicente Nova, Carmen Bachiller, Juan R. Sánchez and Vicente E. Boria
Instituto de Telecomunicaciones y Aplicaciones Multimedia. Universitat Politècnica de València

Abstract: This work presents the practical realization of a power divider and a 90º hybrid directional coupler in Empty Substrate Integrated Coaxial Line (ESICL) for C-band frequency applications. This new type of transmission line is very promising in terms of electric performance, bandwidth, integration with

other planar circuits and manufacturing simplicity. The ESICL has been designed for obtaining a wide monomode bandwidth with a characteristic impedance of 50 Ω. Furthermore, an improvement of the efficient transition between the ESICL and the Grounded Coplanar Waveguide (GCPW), used as feeding line, is also proposed. The passive devices built using this technology are reduced in mass and volume, keep robustness and provide a well balanced power division, as well as reduced losses and high isolation in the whole operational bandwidth. Two prototypes have been manufactured and the experimental results are in good agreement with the simulated designs.

9:30h S6.2.2 Design of passive network for a Single Balanced Mixer at 90 GHz with low LO power supply

Alberto-José Moreno-Montes[1], Alejandro Rivera-Lavado[1], Guillermo Carpintero[2], Luis-Enrique García-Muñoz[1], Daniel Segovia-Vargas[1]
[1]Dept. of Signal Theory and Communications. Carlos III University of Madrid
[2]Dept. of Electronic Technology. Carlos III University of Madrid

Abstract: This paper presents the design of the passive network of a Single Balanced Mixer in GCPW technology working at W-band as a part of a receiver system. In particular the design has been done for a frequency between 84 and 96 GHz, with an IF frequency of 2 GHz. RF port is a WR-10 standard port, which enables an easy connection of a horn antenna, being also included in this paper WR-10 to GCPW transition design. The chosen diode for the mixer is 3DSF5 Zero-Bias Diode from ACST, working with photonic local oscillator (LO) power between 10dBm and 2dBm without DC bias. This configuration offers an alternative solution to commercial mixer with higher power constraints.

9:45h S6.2.3 Rectena de banda ancha para la recolección de energía electromagnética ambiental

Ana López Yela[1], Daniel Segovia Vargas[1], Vicente González Posadas[2]
[1]Dept. de Teoría de la señal y Comunicaciones, Universidad Carlos III de Madrid
[2]Dept. de Teoría de la señal, Universidad Politécnica de Madrid

Abstract: A rectenna prototype is presented for feeding low input power devices, such as wireless sensor networks, through ambient electromagnetic energy harvesting. With a broadband antenna operating from 1.6 to 2.6 GHz, it is possible to scavenge energy from GSM (1800 MHz), UMTS (2100 MHz) and WIFI (2400 MHz), getting a rectification efficiency up to 48% at -15 dBm when a voltage doubler topology is used at single tone. Simulations and measurements are included to demonstrate the reliable performance of the rectenna prototype under low input power levels. This prototype is the first step towards the design of a temperature sensor without batteries.

10:00h S6.2.4 Experimental Design of a 2.45-GHz Patch Antenna Array for RF Energy Harvesting

Natalia Marcos-Iglesias, Jorge M. Villar, Yolanda Campos-Roca, Luis Landesa
Dept. of Computer and Communication Technologies. University of Extremadura

Abstract: Technologies are improved day by day. Devices which support the various technologies are also increased. The possible self-sustaining operability through energy harvesting is being explored. Among this recent researches are focused on RF field due to the available energy in the different frequency bands and its advantages against solar energy limitations. Thus, the design and experimental characterization of a microstrip patch antenna array for RF energy harvesting is provided. The proposed

antenna is printed in FR-4, it resonates at 2.45 GHz and a maximum gain of above 10 dBi is achieved. Return losses higher than 10 dBs are obtained in a 150-MHz bandwidth around the operation frequency.

10:15h S6.2.5 RF-DC rectifiers for energy harvesting from GSM and WiFi bands

Jorge M. Villar, Natalia Marcos-Iglesias, Yolanda Campos-Roca, Luis Landesa
Dpto. de Tecnología de los Computadores y de las Comunicaciones. Universidad de Extremadura

Abstract: The increase in the number of devices that use WiFi signals creates high environmental WiFi energy levels. Also, GSM signals are widely present in the environment. The use of RF energy to feed low-power devices is known as RF energy harvesting and allows to recycle this ambient energy. Rectifiers are key elements that determine the performance of an RF harvesting unit. In this work, three RF-DC rectifier designs are comparatively investigated in terms of power conversion efficiency (PCE) and output voltage level. The circuits are based on FR4 substrates for low-cost implementation in printed circuit board (PCB) technology. The half-way rectifiers for GSM and WiFi bands achieve simulated PCE values of 70.2 % and 65.9 %, respectively, and output voltages of 3 V. A dual-band multiplier achieves a PCE value of 52.2 % at 915 MHz and 52 % at 2.4 GHz. A prototype of this multiplier design has been built and measured, producing a DC output voltage of 4.6 V.

SESIÓN 6.3: Sesión especial: Compatibilidad electromagnética

VIERNES, 9:15-10:30
Presidentes de sesión: **Antonio Lozano Guerrero y Juan Vicente Balbastre Tejedor**
Lugar: Sala Andalucía III

9:15h S6.3.1 Apantallamiento Electromagnético de Materiales Planares en Guía de Onda en Régimen Multimodal

Antonio José Lozano-Guerrero[1], Marina-Carricondo-Chalud[1], Juan Vicente Balbastre Tejedor[2], Mohamed Sidi Benhamou[3], Juan Monzó-Cabrera[1], and Alejandro Díaz-Morcillo[1].
[1]Departamento de Tecnologías de la Información y las Comunicaciones Universidad Politécnica de Cartagena (UPCT)
[2]Departamento de Comunicaciones Universidad Politécnica de Valencia (UPV)
[3]Département du Second Cycle. Filière Electrotechnique Ecole Supérieure en Sciences Appliquées de Tlemcen Tlemcen, Algerie.

Abstract: The measurement of the shielding effectiveness of planar materials can be carried out in various ways. Configurations in anechoic chamber or open space simulating plane waves can be used and also set ups with transmission lines, either coaxial or waveguide lines. When working with these last ones particularly, the zone of operation in frequency of these techniques goes from the fundamental mode that propagates up to the second in what it is called the monomode region. However, the idea that we propose in this paper, is to increase the frequency of operation of these devices. This project will study the feasibility of obtaining shielding effectiveness at higher frequencies than the second mode in a rectangular waveguide increasing the bandwidth of the devices traditionally used for this purpose and allowing the direct measurement for two orthogonal polarizations.

9:30h S6.3.2 Calculation and Reduction of Parasitic Inductances of Film Capacitors

P. González-Vizuete[1], F.Fico[1], M.J.Freire[2], J.Bernal[1]
[1]Departamento de Física Aplicada III. Universidad de Sevilla.
[2]Departamento de Electrónica y Electromagnetismo. Universidad de Sevilla.

Abstract: This work presents a simple and accurate method for the calculation of both the self-inductance and the mutual inductance between thin-film capacitors, placed in close proximity in electromagnetic interference filters. From physical considerations regarding the impact of both skin and proximity effects, we approximate the currents flowing inside the capacitors at high frequencies by strip currents. This hypothesis is supported by electromagnetic simulations and measurements in this paper. On the basis of this model, we use analytical expressions to calculate both the self-inductance and the mutual inductance as a function of purely geometrical parameters such as the size of the capacitors, their orientation and the distances between them. Because no previous impedance or measurements of network parameters are required to estimate these inductances, this technique is suitable for virtual prototyping design. We have constructed and measured several test boards to check the accuracy of the method and to identify its scope and limits. Also, in this work we employ this technique to study the impact of a design strategy that exploits mutual inductance between capacitors to reduce the negative effects of their parasitic inductance. We demonstrate that this design strategy significantly improves the attenuation provided by filters with thin-film capacitors at high frequencies.

9:45h S6.3.3 Characterization of Common Mode Chokes at High-Frequencies for Aeronautical Applications

C. Domínguez-Palacios[1], J. Bernal[2], M. M. Prats[1]
[1]Departmento de Ingeniería Electrónica, Universidad de Sevilla.
[2]Departmento de Física Aplicada III, Universidad de Sevilla.

Abstract: This work presents a method to characterize twophase common mode chokes at high frequencies. This method only requires a measurement which can be performed with a spectrum analyzer with tracking generator. By performing a modal analysis of a high-frequency circuit model of the common mode choke regarded as a four-ports device we demonstrate that when excited in a simple setup the common-mode and differential-mode resonances of the two windings of the common mode choke can be plainly observed. This permits us to predict the response of the common mode choke to common mode and differential mode excitations with a simple measurement, i.e. two different setups are not required. Also it allows us to develop a method to determine the high-frequency parameters of the circuit model from the result of this simple measurement. Different commercial two-phase common-mode chokes have been measured and the predicted performance of the model has been compared with measured responses. We have verified that in all the cases the measured transmission coefficient exhibits the resonant behavior predicted by the theoretical analysis.

10:00h S6.3.4 Experimental Evaluation of a Printed Circuit Board Electromagnetic Model

Antonio José Lozano-Guerrero, Antonio Albero-Ortiz, Juan Monzó-Cabrera and Alejandro Díaz-Morcillo.
Departamento de Tecnologías de la Información y las Comunicaciones Universidad Politécnica de Cartagena (UPCT)

Abstract: In this paper the evaluation of an electromagnetic equivalent of a printed circuit board PCB has been carried out inside a metallic enclosure with an aperture and assuming a normal impinging plane wave on the cabinet. The equivalent was obtained in a closed cavity with two protruding probes using different optimization techniques. The empty cavity and the cavity loaded for two scenarios have been studied to assess the benefits and the drawbacks of the equivalent under evaluation using the shielding effectiveness ratio. The quality factor and the minimum level of shielding effectiveness for the first appearing resonance have also been obtained to compare the simulated and measured obtained values.

10:15h S6.3.5 Topside Electromagnetic Compatibility (EMC) of Communication Systems in the V/UHF Frequency Band

David Larios[1], Victor F. Martín[1], F. Obelleiro[2], J.L. Rodríguez[2] and José M. Taboada[1]
[1]Dept. of Technology of Computers and Communications. University of Extremadura
[2]Dept. of Signal Theory and Communications. University of Vigo

Abstract: In this paper we present a complete example addressing the Electromagnetic Compatibility of on board communication systems operating in the VHF and UHF frequency bands. Different interference margins are calculated for each transmitter and receiver pair starting from the fullwave prediction of the mutual couplings, which are accurately calculated taking into account the presence of the superstructure and the rest of the antennas. The terminology of the International Telecommunication Union Recommendations (ITU-R) and European Telecommunications Standards Institute (ETSI) is used when applicable.

SESIÓN 6.4: Sesión especial: Comunicaciones móviles, planificación y optimización de redes

VIERNES, 9:15-10:30
Presidentes de sesión: **Pablo Muñoz Luengo e Isabel de la Bandera Cascales**
Lugar: Seminario 1+2

9:15h S6.4.1 Arquitectura de Red de Comunicaciones Inalámbricas para la Industria 4.0

M.C. Lucas-Estañ, M. Sepulcre, J. Gozálvez
UWICORE Laboratory, Universidad Miguel Hernández de Elche (UMH)

Abstract: Under the Industry 4.0 paradigm, factories of the future will be digitalized and networked factories where components will be able to communicate with each other, and intelligence will be spread among the different elements of the production systems. Different industrial applications will coexist in the same environment demanding very different and stringent communication requirements in terms of latency, reliability and data rate. These applications can vary from virtual reality applications that require high throughput levels to time-critical automation processes demanding low data rates and ultra-high latency. The communication network will be one of the key technological enablers of Industry 4.0. In this context, this paper proposes a hierarchical management architecture that allows the integration of different communication technologies. The proposed architecture considers the use of RAN Slicing and Cloud RAN as enabling technologies to achieve the flexibility, scalability and adaptation capabilities required to support the high-demanding and diverse industrial environment.

9:30h S6.4.2 Evaluación del protocolo Listen Before Talk en el estándar 3GPP Licensed Assisted Access

Eduardo Baena, Sergio Fortes, Raquel Barco
Universidad de Málaga, Andalucía Tech, Departamento de Ingeniería de Comunicaciones

Abstract: The rapid proliferation of user devices with access to mobile broadband such as smartphones or tablets has been a challenge from both operational and deployment point of view. With the incorporation of new services with high demand for bandwidth such as video in 4K or with very low latency restrictions such as telecontrol, it has become necessary to expand the existing capacity by including new bands, among which the 5GHz is a good candidate. Long Term Evolution (LTE) operation in this band implies the coexistence with other existing technologies such as WiFi, which use is quite widespread. This paper explores the impact of standarized media access techniques in the 3GPP LTE-Licensed Assisted Access to unlicensed band in terms of both performance and coexistence.

9:45h S6.4.3 Clasificación de tráfico encriptado mediante aprendizaje no supervisado en redes LTE

J.F. Cantón, J.L. Bejarano-Luque, P.A. Sánchez, M. Toril
Dpto. de Ingeniería de Comunicaciones, ETSI Telecomunicación, Universidad de Málaga

Abstract: Traffic classification is an extremely useful piece of information for networks operators. However, traditional approaches are inaccurate when applications use non-standard ports and encrypted traffic. This paper presents a methodology for encrypted traffic classification in the radio interface of a Long Term Evolution (LTE) network based on machine learning. For this purpose, events in connection traces of an access radio LTE network are first collected. Then, classification is based on the attributes of each connection by using unsupervised clustering algorithms, namely k-means and k-medoids. The potential and limitations of this kind of algorithm are analyzed. The proposed algorithm is tested over a real trace dataset.

10:00h S6.4.4 Mejora de la eficiencia energética en redes 5G mediante el apagado inteligente de celdas

Francisco Luna[1], Rafael M. Luque Baena[1], Jesús Martínez[1], Juan F. Valenzuela-Valdés[2], Pablo Padilla[2]
[1]Dept. of Languages and Computer Science Universidad de Málaga
[2]Dept. Signal Theory, Telematics and Communications Universidad de Granada

Abstract: The energy consumption foreseen for the next generation of mobile communications (5G) is expected to be greater than that of 4G systems. However, among the 5G design principles, the carbon footprint of the network has to be reduced while, at the same time, its performance has to grow considerably. A well-known approach in the literature to address such issues lies in deploying an ultra-dense set of small base stations that are capable of, in some scenarios, to face the huge traffic demands and, in others, to save energy. In this context, this work deals with the cell switch-off problem, which is known as a promising approach to reduce the energy consumption of 5G networks. It has been formulated as a multi-objective optimization problem that has been tackled with different multi-objective metaheuristics. In order to show the feasibility of the approach, the algorithms have been evaluated over a set of scenarios with different densification levels, reaching major energy savings in all of them.

10:15h S6.4.5 Modelado de TCP en un entorno celular con Dual Connectivity

J. Burgueño, I. de la Bandera, D. Palacios, R. Barco
Dpto. de Ingeniería de Comunicaciones. Universidad de Málaga

Abstract: This paper proposes a TCP implementation in a system-level simulator. This LTE-Advanced simulator provides Dual Connectivity (DC), which allows user equipments (UEs) to receive data simultaneously from two evolved NodeBs (eNBs) in order to boost the performance in a heterogeneous network. In this work, a TCP abstraction is described to predict TCP version Reno performance in an accurate and computationally efficient way. The proposed model is used to show the impact of DC on the user throughput and dropped packets when UEs are downloading a file through TCP.

SESIÓN 6.5: Antenas (Parte 2)

MIÉRCOLES, 9:15-11:00
Presidentes de sesión: **Pablo Sánchez Olivares y José Luis Masa Campos**
Lugar: Sala Andalucía I

9:15h S6.5.1 A Study on Monopulse Errors for an Active, Electronically Controlled Beam Steering, Truncated Pyramid, Phased Array for IFF Applications

A. Álvarez Mellado[1] , C. Zarzuelo Torres[1], A. Asensio López[2] , J. Gismero Menoyo[2], M. Sierra Pérez[2]
[1]Indra
[2]Information, Processing and Telecommunication Center, Universidad Politécnica de Madrid

Abstract: This article describes the architecture of a truncated-pyramid phased array which integrates a Directive Antenna and an Omnidirectional Antenna in one single mechanical structure. Both antennas provide service for an Interrogator equipment of IFF (Identification Friend or Foe) application. The outstanding contribution of this article lies on the fact that the Directive Antenna is a monopulse, electronically controlled beam steering, active phased array. The paper also includes a study on the most critical requirement of the system: the monopulse precision. In this study the effect of errors on the radiant part is treated separately from the errors caused by the receiver processor.

9:30h S6.5.2 Miniaturized Top-Metallized Rectangular Dielectric Resonator Antenna

Mario Pérez-Escribano[1], Francisco Javier Herraiz-Martínez[2] and Enrique Márquez-Segura[3]
[1,3]Dpto. de Ingeniería de Comunicaciones, E.T.S. Ingeniería de Telecomunicación, Universidad de Málaga
[2]Instituto de Investigación Tecnológica, Escuela Técnica Superior de Ingeniería ICAI, Universidad Pontificia Comillas, Madrid

Abstract: In this paper, a modal analysis of a rectangular dielectric resonator antenna (DRA), with unconventional boundary conditions, is carried out. Analytical equations of the fields inside the resonator and simulations are presented, showing that if a resonator is mounted over a ground plane and loaded by a top metallic sheet, there is a miniaturization of the electric size of the new antenna, without significant deterioration of performance. Furthermore, dual-band responses can be achieved with this configuration.

9:45h S6.5.3 Novel Reflectarray Cells For Transmit and Receive Multi-Spot Satellite Antennas in Ka Band

Daniel Martínez de Rioja[1], José A. Encinar[1], Rafael Florencio[1], Rafael R. Boix[2]
[1]Information Processing and Telecommunications Center, Universidad Politécnica de Madrid (UPM)
[2]Dpto. de Electrónica y Electromagnetismo, Universidad de Sevilla. Facultad de Física.

Abstract: A new reflectarray cell operating in dual-frequency reflectarray is proposed in this communication to provide two adjacent beams in orthogonal circular polarizations at transmit and receive frequencies (20/30 GHz) in Ka-band. The reflectarray cell consists of two dielectric layers with two levels of printed elements (dipoles and circular arcs). The cell response is characterized for both circular polarizations at each frequency, and the design procedure for a reflectarray based on the proposed cell is described. This concept applied to parabolic reflectarray antennas will allow to produce two adjacent beams per feed at transmission and reception through the simultaneous use of polarization and frequency discrimination, allowing a reduction in the number of feeds and antennas required for current multi-spot satellite in Ka-band.

10:00h S6.5.4 Técnica de Mejora de Ganancia y Relación Axial para Antenas Espirales Compactas

Andrea García Estellés, Juan José Sánchez Martínez, Ana Cristina Gago-Lancho, Francisco Vázquez Vázquez
Indra Sistemas S.A., Madrid, Spain.

Abstract: An enhancement technique for both the gain and axial ratio of cavity-backed spiral antennas at low frequencies is presented. By the addition of appropriate non-metallic materials in the upper cavity walls the design of compact antennas is allowed without a significant performance degradation at low frequencies. To validate this technique, a two-arm Archimedean spiral antenna operating in the frequency band from 2 to 18 GHz is designed and simulated. The results obtained show a considerable gain and axial ratio improvement at 2 GHz.

10:15h S6.5.5 Antena Bi-banda con Conformación de Dos Haces Simultáneos Para Sistemas GNSS-R

R. Onrubia, D. Pascual, J. Querol, H. Park, A. Camps.
CommSensLab – Unidad María de Maeztu / Departmento de Teoría de la Señal y Comunicaciones
Universitat Politècnica de Catalunya e IEEC/UPC, UPC Campus Nord

Abstract: Global Navigation Satellite Systems – Reflectometry (GNSS-R) is a relatively new remote sensing technique that benefits from GNSS signals as signals of opportunity as a bistatic radar. These signals can be processed as a scatterometer by measuring the relative scattered power, as an altimeter by measuring the relative delay between the direct and the scattered signals, and as an unfocused Synthetic Aperture Radar (SAR) with very short coherent integration times (typically a few millisecons). Wider bandwidth signals provide an opportunity to increase the performance of some GNSS reflectometry applications (i.e. altimetry). The Microwave Interferometric Reflectometer (MIR) is an instrument developed at UPC to compare different GNSS-R techniques, notably the conventional and interferometric ones, and assess the capabilities of these new signals and bands of the GPS and Galileo systems (L1/E1 and L5/E5). This paper describes the MIR beamforming system.

10:30h S6.5.6 Estudio electromagnético de una antena bipuerto de parche rectangular acoplada por abertura con stub rectangular

Yordanis Alonso-Roque
Dpto. Ingeniería de Comunicaciones, E.T.S. Ingeniería de Telecomunicación, Universidad de Málaga

Abstract: An electromagnetic study of two-port aperture-coupled rectangular microstrip patch antenna with rectangular stub was carried out. The stub is located perpendicularly to the microstrip line and centered with the slot forming a strip-slot structure. This topology allows to improve the matching behavior and some radiation characteristics with regard to the conventional structure. A matching bandwidth of 80% approximately was achieved, resulting a 20% more than the obtained with the homologous conventional structure. The lattice network modeling of the studied structure was performed and it allows to explain the reached impedance bandwidth. The analyzed structure shows a broadside radiation pattern, radiating more towards the plane that contains the patch, with a stability of a 60% of its matching bandwidth. The proposed structure shows an enhancement of the purity of linear polarization fundamentally in the main direction of radiation. Moreover, a little improvement of front-to-back ratio was observed.

10:45h S6.5.7 Estudio de la geometría de una apertura coaxial para su uso en un microscopio por microondas escáner en campo próximo

José D. Gutiérrez-Cano, José M. Catalá-Civera, Pedro Plaza-González, Gabriel Llorens Vallés, Felipe L. Peñaranda-Foix
Instituto ITACA. Universitat Politècnica de València

Abstract: Near-Field Scanning Microwave Microscopes (NSMM) are devices that get the electromagnetic response in a scale much lower than the used wavelength. In this paper, the study of a coaxial aperture to be used as a probe in a robust and cost-effective NSMM in the micrometric scale is shown. The parameters analysed comprised the coaxial inner conductor, the probe-sample distance and the tip of the probe. To demonstrate the validity of the results, a laboratory scale NSMM has been built and tested together with two coaxial apertures. An NSMM device in the micrometric scale may be useful in several new research applications.

SESIÓN 6.6: Sesión especial: Bioingeniería y e-health

VIERNES, 9:15-10:30
Presidentes de sesión: **Miguel Ángel López Gordo y Jesús Minguillón Campos**
Lugar: Seminario 6

9:15h S6.6.1 Diseño centrado en usuario para e-Salud: Sistema e-Nefro

Jorge Calvillo Arbizu[1,2], Isabel Román Martínez[2], Javier Reina Tosina[1,3]
[1]Grupo de Ingeniería Biomédica
[2]Dpto. Ing. Telemática
[3]Dpto. Teoría de la Señal y Comunicaciones, Escuela Técnica Superior de Ingeniería, Universidad de Sevilla

Abstract: User acceptance influences the success of e-Health approaches. End-users often stress misalignments among their problems and the solutions that technology systems aim to solve. In other cases, systems developed are unfriendly or unadjusted to the daily practice of clinicians or patient's life. Adopting user-centred design and development techniques is crucial to maximize user acceptance. However, users are often assumed to be a homogeneous group with the same set of requirements, what leads to an ineffective identification and regard of user requirements. Furthermore, usability and accessibility issues must be carefully addressed to guarantee also the right alignment of solutions with user needs. This work presents the development of an e-Health system for renal patients at home by adopting user-centred design practices, and usability and accessibility standards. Requirements were considered for every kind of user, what resulted in a multi-faceted e-Health system implying different technologies and functionalities regarding each target user.

9:30h S6.6.2 Cloud Data Base Construction Method for Speed Diagnosis of Infectious Diseases

Alberto Garcés[1,2], Vera Pospelova[1], José Luis Castillo Sequera[3,5], José Manuel Gómez-Pulido[3,5], José María Gutiérrez Martínez[3], María-Luz Polo-Luque[4,5]
[1]Foundation for Biomedical Research of Príncipe de Asturias Hospital (FIBHUPA), Alcala.
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[3]Dept. of Computer Science. University of Alcala (UAH)
[4]Dept. of Nursing and Physiotherapy. University of Alcala (UAH)
[5]Ramón y Cajal Institute of Sanitary Research, Madrid, Spain

Abstract: A joint medical and computing research group has developed a full system to build a clinical database (DB) in the Cloud to extract knowledge for the speed diagnosis of infectious diseases. It is a significant step forward as traditionally the lack of data prevents the development of medical recommenders to anticipate the diagnosis. In addition, the steadily data update enables efficient telecare for individual patients, raising the satisfaction level of the patient and relatives. The usability of the system have been tested with satisfactory results.

9:45h S6.6.3 Neuroingeniería lúdica e inclusión

Eduardo Pérez Valero[1], Jesús Minguillón[1], Miguel Ángel López Gordo[2]
[1]Dpto. de Arquitectura y Tecnología de Computadores, Universidad de Granada
[2]Dpto. de Teoría de la Señal, Telemática y Comunicaciones, Universidad de Granada

Abstract: We propose K-Attack as a ludic application for the detection of visual attention based on visual evoked potentials (SSVEP). In this game, the participant is stimulated by a reversing checkerboard that flickers at a frequency of 15 Hz. This stimulus evokes cerebral signals of the same frequency whose energy depends on the level of visual attention. Then, these signals are acquired by means of an electrophysiology acquisition system and the level of attention exerted by the participant is classified. For attention detection, these parameters are measured: the power of the SSVEP, the power of the alpha band (8 Hz - 13 Hz) and the power of adjacent spectral bins. Classification is performed by means of thresholds. This principle is presented in the context of a game, in which the participant must gaze at the center of random attacking weapons (i.e. reversing checkerboards) that approximate and must stop them just by using visual attention. This game would allow the training of the attention capacity of people with attention disorders.

10:00h S6.6.4 Estudio de la detección de caídas utilizando el algoritmo SVM

José Antonio Santoyo Ramón, Eduardo Casilari Pérez, José Manuel Cano García
Dpto. de Tecnología Electrónica. Universidad de Málaga.

Abstract: La sociedad se enfrenta a un gran problema de salud pública que se agrava debido al envejecimiento de la población, las caídas. Estas son una de las principales causas de muerte en ancianos y en grupos de población que desarrollan actividades de riesgo. En este sentido las tecnologías pueden proporcionar soluciones para mejorar la situación. En este trabajo se han analizado y estudiado dos repositorios diferentes de movimientos y caídas (UMAFall y SisFall) concebidos para probar algoritmos de decisión en sistemas automáticos de detección de caídas. Los objetivos del estudio son varios: esclarecer cuáles son las características de las señales de acelerometría más significativas a la hora de identificar una caída, caracterizar las prestaciones que proporciona el algoritmo de aprendizaje supervisado SVM en este tipo de escenario y, por último, analizar la posibilidad de extrapolar el aprendizaje conseguido con cierta base de datos cuando se testea con otra. Como novedad con respecto a otros trabajos en la literatura, se ha evaluado de manera sistemática, la significación estadística de los resultados mediante análisis de varianza (ANOVA).

10:15h S6.6.5 UWB 3D Printed Microwave Stethoscope Antenna for Body Sensing

Saba Rashid[1,2], A. Garrido[1], A.Aguasca[1], S. Blanch[1], Y. Ding[2], J. Romeu[1], L. Jofre[1]
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[2]College of Information Sciences and Technology, Donghua University, Shanghai 201620, China

Abstract: This paper presents the design and fabrication of a 3D printed UWB double ridged horn (DRH) antennas to measure the in-vivo electrical (permittivity and conductivity) parameters of different parts (tissues) of the human body. The intended operational frequencies of the proposed DRH antennas cover the band of interest for microwave sensing and imaging 0.3 to 3 GHz. Through this design, we are approaching as much as possible close to the concept of a compact probe and because it is intended for use in biomedical applications, therefore the idea of a "compact microwave stethoscope" may help to visualize the concept better among the medical community. Since, the device will be used for probing the human body it needs to be well matched to its electrical parameters that in average may be approached by a permittivity in the range of 40 and 81 that will help to reduce the size and improve the impedance matching. We have developed through 3D printing two physically small DRH antennas dielectrically matched to the permittivity of human body.

SESIÓN 7.1: Sesión especial: Procesado multidisciplinar de señales: sísmicas, acústica, voz, imagen, etc. (Parte 2)

VIERNES, 10:45-11:30
Presidentes de sesión: **Sonia Mota Fernández y Luz García Martínez**
Lugar: Sala Andalucía I

10:45h S7.1.1 New strategies for recording Auditory Brainstem Responses and Middle Latency Responses

Marta Martínez[1], Isaac M. Álvarez[2], Joaquín T. Valderrama[3], Ángel de la Torre[2], José Luis Vargas[1], Luz García[2], Manuel Titos[2], Ángel Bueno[2]
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Abstract: Human hearing is developed by a bilateral auditory system. People are constantly stimulated by different noises. Binaural hearing allows people to understand language in noisy situations. Clinic diagnosis of hearing loss is made with audiometry test, but they evaluate auditory system in a silence situation. Auditory brainstem response (ABR) and Middle Latency Response (MLR) are a representation of neural activity of the auditory brainstem after a sound stimulus. ABR and MLR are gold standard diagnosis test for hearing loss. Nowadays there is not a protocol to study the auditory system under noise conditions. This work presents objective test ABR and MLR with different sound stimulus and with different noise conditions. This paper shows the results of a preliminary study, evaluating in an objective way functional auditory response of a subject in a noisy environment.

11:00h S7.1.2 Sistema de ayuda a la interpretación de partituras musicales mediante MIDI y códigos QR

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Dpto. de Ingeniería de Comunicaciones, E.T.S.I. Telecomunicación, Universidad de Málaga

Abstract: This document describes the design and implementation of a service that help users with no or a few musical knowledge in sheet music reading. The service is provided by means of MIDI information embedded into QR codes that are printed in the own sheet music and later decoded and played using a smartphone. The most suitable version of QR codes is identified as a tradeoff between the minimum size allowing the right decoding and the maximal size not affecting to the sheet music reading. On the other side, MIDI information is carefully selected and compressed to increase the information transferred by each QR code, thus reducing the number of QR codes to be printed. The service presented is focused on the particular case of choral music where many amateur participants need help to read the sheet music.

11:15h S7.1.3 Algoritmo de adaptación DASH sensible al tamaño del segmento

Román Belda, Ismael de Fez, Pau Arce, Juan Carlos Guerri
Instituto de Telecomunicaciones y Aplicaciones Multimedia (iTEAM), Universitat Politècnica de València

Abstract: Adaptation algorithms are one of the key elements regarding the performance of the Dynamic Adaptive Streaming over HTTP (DASH) video standard. Usually, adaptation algorithms use the average video bitrate to be compared with the estimated bandwidth as well as the playback buffer. This approach can cause stalls when there are peaks in the video segment sizes, since encoded videos have inherently variable bitrate, despite being encoded with a target bitrate. In this sense, this paper proposes an adaptation algorithm called Look Ahead which takes into account the bitrate variability of the videos in order to calculate in advance the appropriate representation that minimizes the number of stalls during the playback. The evaluation carried out proves that the proposed algorithm outperforms other relevant

adaptation algorithms both in number and duration of video playback stalls, but with hardly decreasing the average quality during playback.

SESIÓN 7.2: Componentes y Circuitos Pasivos de Microondas (Parte 2)

VIERNES, 10:45-11:30
Presidentes de sesión: **José Ramón Montejo Garai y Rafael Rodríguez Boix**
Lugar: Sala Andalucía II

10:45h S7.2.1 Alimentador compacto basado en un polarizador septum para antena MTS de doble polarización

A. Tellechea[1], J. Teniente[2,3], R. Gonzalo[2,3], I. Ederra[2,3] y J.C. Iriarte[2,3]
[1]ANTERAL S.L.
[2]Dpto. de Ingeniería Eléctrica y Electrónica. Universidad Pública de Navarra
[3]Instituto de Smart Cities (ISC), Universidad Pública de Navarra

Abstract: A compact septum orthomode transducer polarizer at Ku band is shown in this paper. This polarizer has been designed to feed a rotationally symmetric MTS antenna which supports dual circularly polarized broadside radiation pattern (RHCP or LHCP). The proposed septum is placed in a circular waveguide filled with AD1000 material (dielectric constant 10.2). The use of this high dielectric constant material results in a considerably size reduction. Total dimension of the proposed feeding system is 30 mm x 26.53 mm ($1.31\lambda_0 x 1.16\lambda_0$). Two modified SMA connectors have been used to excite the structure. The OMT has been efficiently designed to obtain good reflection (-12 dB) and isolation (20 dB) parameters and the axial ratio at the output port is below 0.75 dB in all the working band.

11:00h S7.2.2 Desfasador Sintonizable con Postes Metálicos en Guía de Onda Rectangular con Fabricación Aditiva

Lucas Polo-López, J.L. Masa-Campos, Jorge A. Ruiz-Cruz
Dpto. de Tecnología Electrónica y de las Comunicaciones, Universidad Autónoma de Madrid

Abstract: In this work the design of a Ku-band reconfigurable phase shifter implemented in waveguide technology is presented. The reconfiguration capability of the device is achieved by the insertion of a pair of adjustable metallic posts. A prototype of this device has been manufactured using a low-cost additive manufacturing technique. This technique is based on the construction of the waveguide structure by means of a 3D printer and its later metallization using a conductive paint. The measured return loss and phase performances of this prototype are compared with the simulated full-wave response of the phase shifter. The good agreement between the measurements and the simulation suggests that the presented manufacturing technique can be a useful tool in the prototyping of waveguide devices.

11:15h S7.2.3 Filtro de Doble-Banda en Tecnología Inverted Microstrip Gap Waveguide integrado con una Antena de Ranura

L. Inclán-Sánchez
Departamento de Teoría de la Señal y Comunicaciones Universidad Carlos III de Madrid

Abstract: This paper presents a new dual stop-band filter based on EBG resonators in inverted microstrip Gap Waveguide Technology. The filter is integrated with a slot antenna to reduce the interferences. The design methodology for configuring the Gap Waveguide and adjusting the response of the radiant element together with the filters is described. A rejection level greater than 15 dB is observed in the results obtained for the filtering antenna.

SESIÓN 7.3: Sesión especial: Radioastronomía

VIERNES, 10:45-11:30
Presidentes de sesión: **Luisa de la Fuente Rodríguez**
Lugar: Sala Andalucía III

10:45h S7.3.1 Optimización de la Quad-Ridge Flared Horn para la estación VGOS del Observatorio de Yebes

A. Baldominos, Ó. García-Pérez, F. Tercero, J. M. Serna, B. Vaquero
Observatorio de Yebes, Instituto Geográfico Nacional (IGN), Yebes

Abstract: Current Very Long Baseline Interferometry (VLBI) and astronomical projects are demanding UWB receivers and feeds (bandwidths from 4:1 up to 10:1). For the feed design, the quad-ridged flared horn (QRFH) is becoming the preferred choice because it is easy to integrate with single-ended low-noise amplifiers, and fits to different telescope magnifications. With the aim of further improving its performance, a genetic algorithm, combining both physical optics and full wave electromagnetic simulations, has been developed for the optimization of the QRFH feed. A complete designed feed fulfilling the VGOS specifications is presented.

11:00h S7.3.2 Forty GHz Instrument polarimeter receiver for Cosmic Microwave Background observations

Eduardo Artal Latorre[1], Enrique Villa Benito[2], Juan Luis Cano de Diego[1], Beatriz Aja Abelán[1], Luisa de la Fuente Rodríguez[1], José Vicente Terán Collantes[3], Angel Mediavilla Sánchez[1]
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[2]now in Instituto de Astrofísica de Canarias. La Laguna (Tenerife)
[3]now in ERZIA Technologies. Santander

Abstract: The receiver for the Forty GHz Instrument (FGI) is a broadband microwave polarimeter to obtain three Stokes parameters (I, Q, U) of Cosmic Microwave Background waves received from the sky. The designed receiver measures I, Q, and U Stokes parameters simultaneously. This paper describes the principle of operation of the polarimeter receiver, and some details of manufactured subsystems, integration and test results. The Forty GHz Instrument is currently under installation in El Teide Observatory, Tenerife (Canary Islands), as one of the systems of QUIJOTE CMB Experiment.

11:15h S7.3.3 Receptor Interferométrico para Radioastronomía de 10 a 20 GHz

L. de la Fuente[1], B. Aja[1], E. Villa[2], E. Artal[1], J.L. Cano[1], A. Mediavilla[1]
[1]Dpto. de Ingeniería de Comunicaciones. Universidad de Cantabria
[2]Actualmente en: Instituto de Astrofísica de Canarias. La Laguna, Tenerife

Abstract: This document describes the scheme and prototype test results of the microwave section of a 10-to-20 GHz interferometer, aimed to obtain polarization data of Cosmic Microwave Background (CMB) radiation from the sky. Test results for an ambient temperature set-up as well as the characterization of all the circuits comprising the receiver are presented. The whole frequency band is split into two subbands using a high selective diplexer in order to reject contamination signals. Commercial parts are used for amplifiers and phase shifters, while own-design circuits have been developed for the diplexer, the microwave correlator and waveguide components.

SESIÓN 7.4: WORKSHOP: Simulación FDTD en EMC mediante SEMBA

VIERNES, 10:45-11:30
Lugar: Seminario 1+2
Dirigen: Alejandra L. Aberasturi, Luis D. Angulo, Miguel R. Cabello, Salvador G. Garcia

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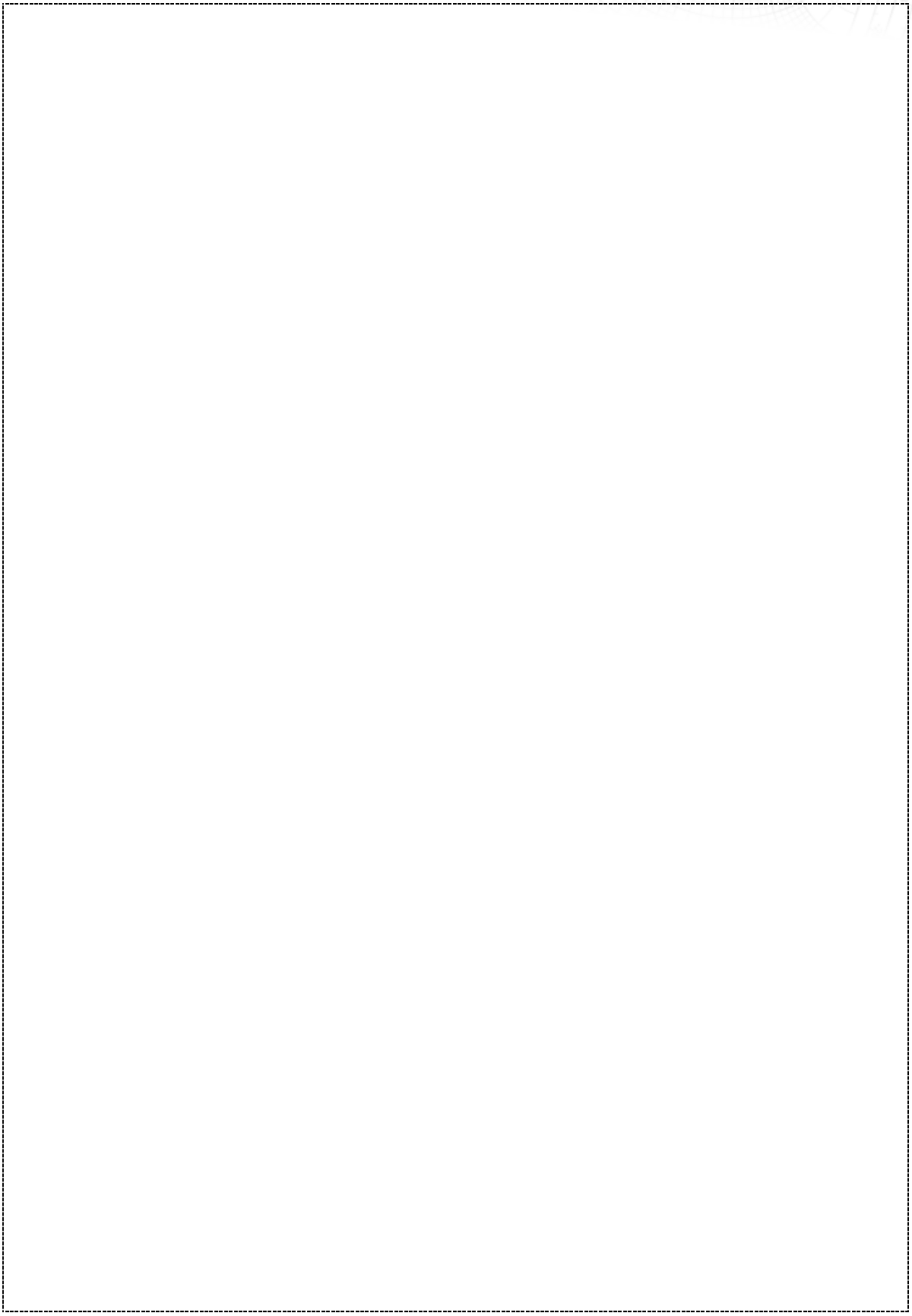

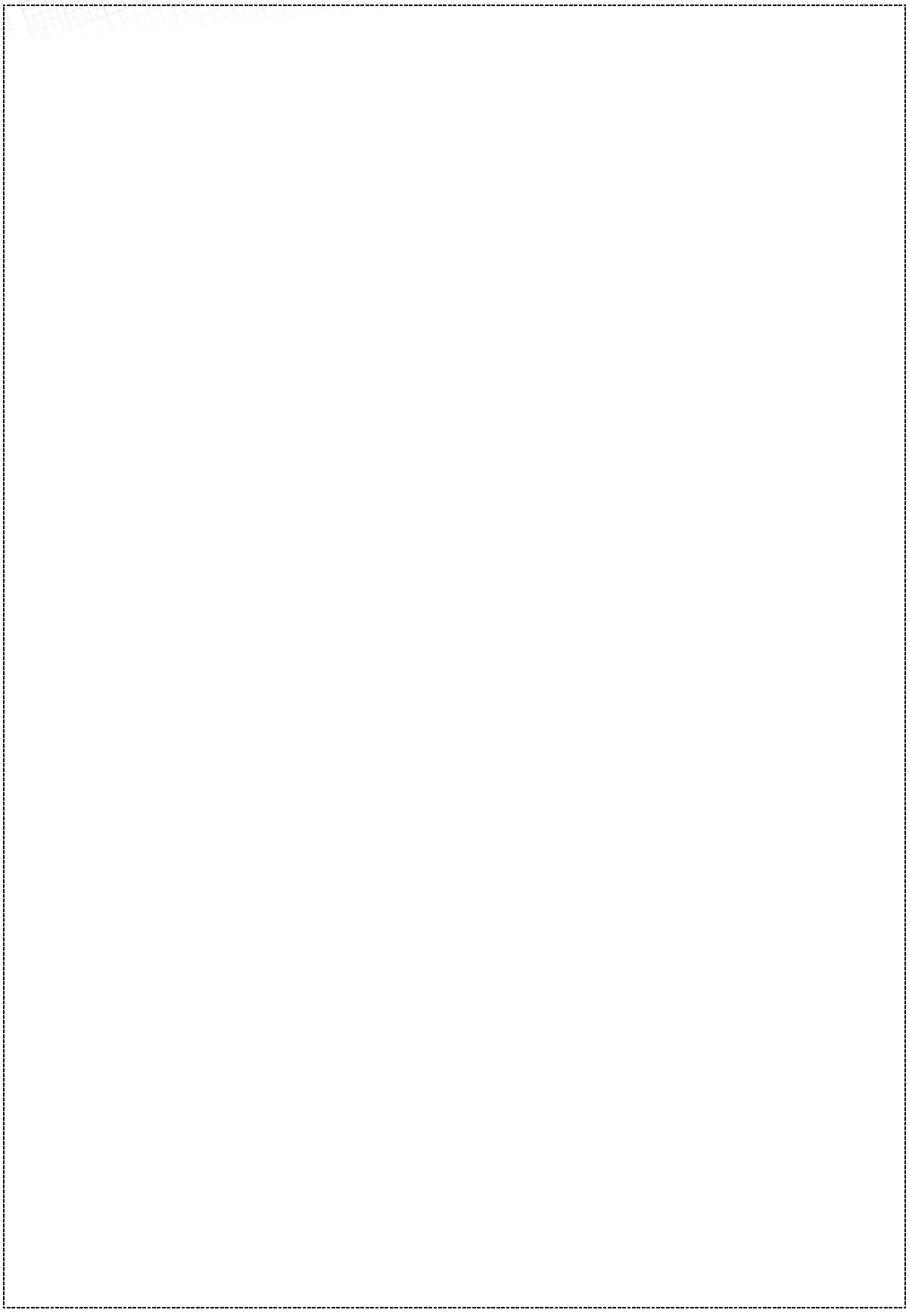

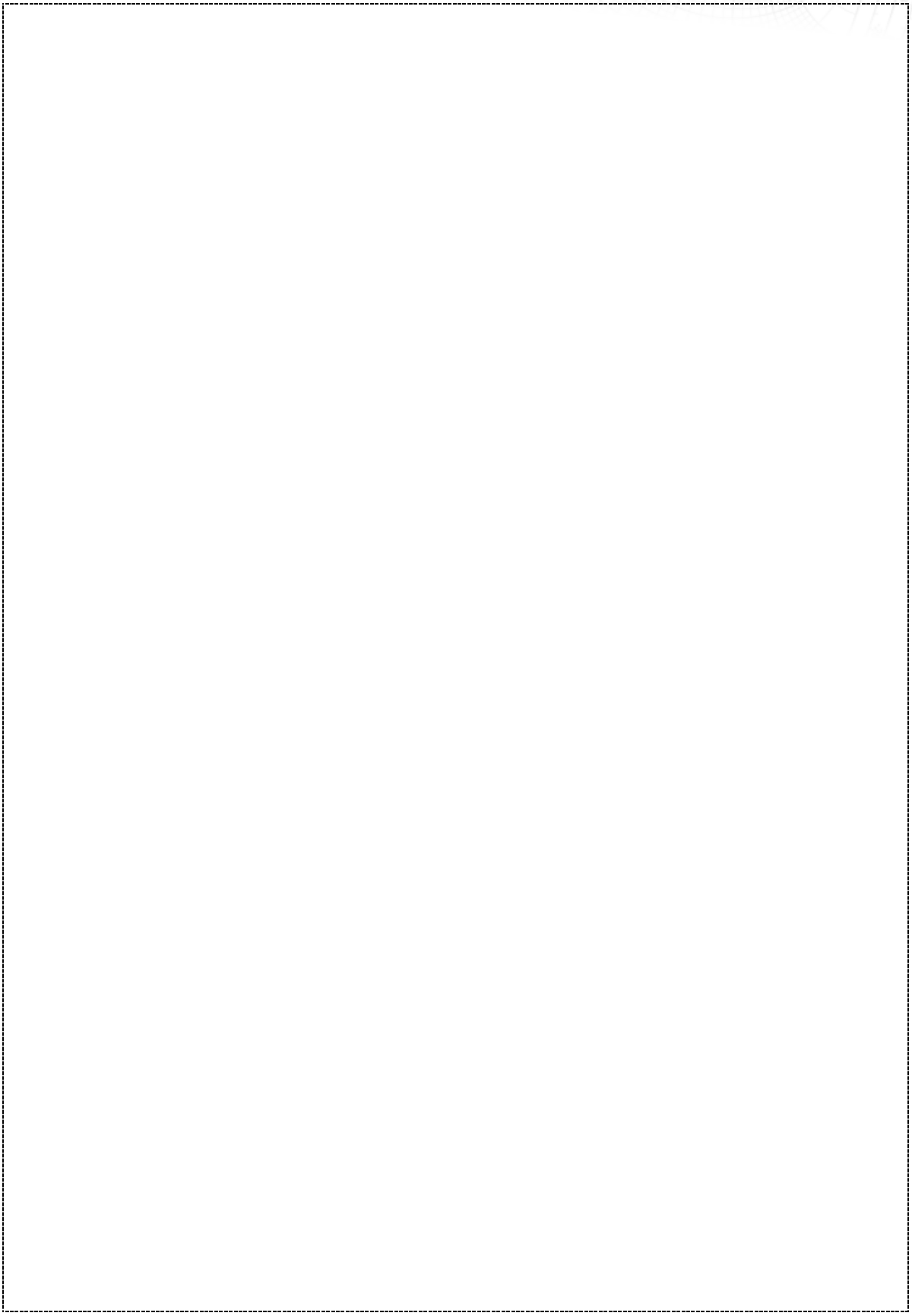

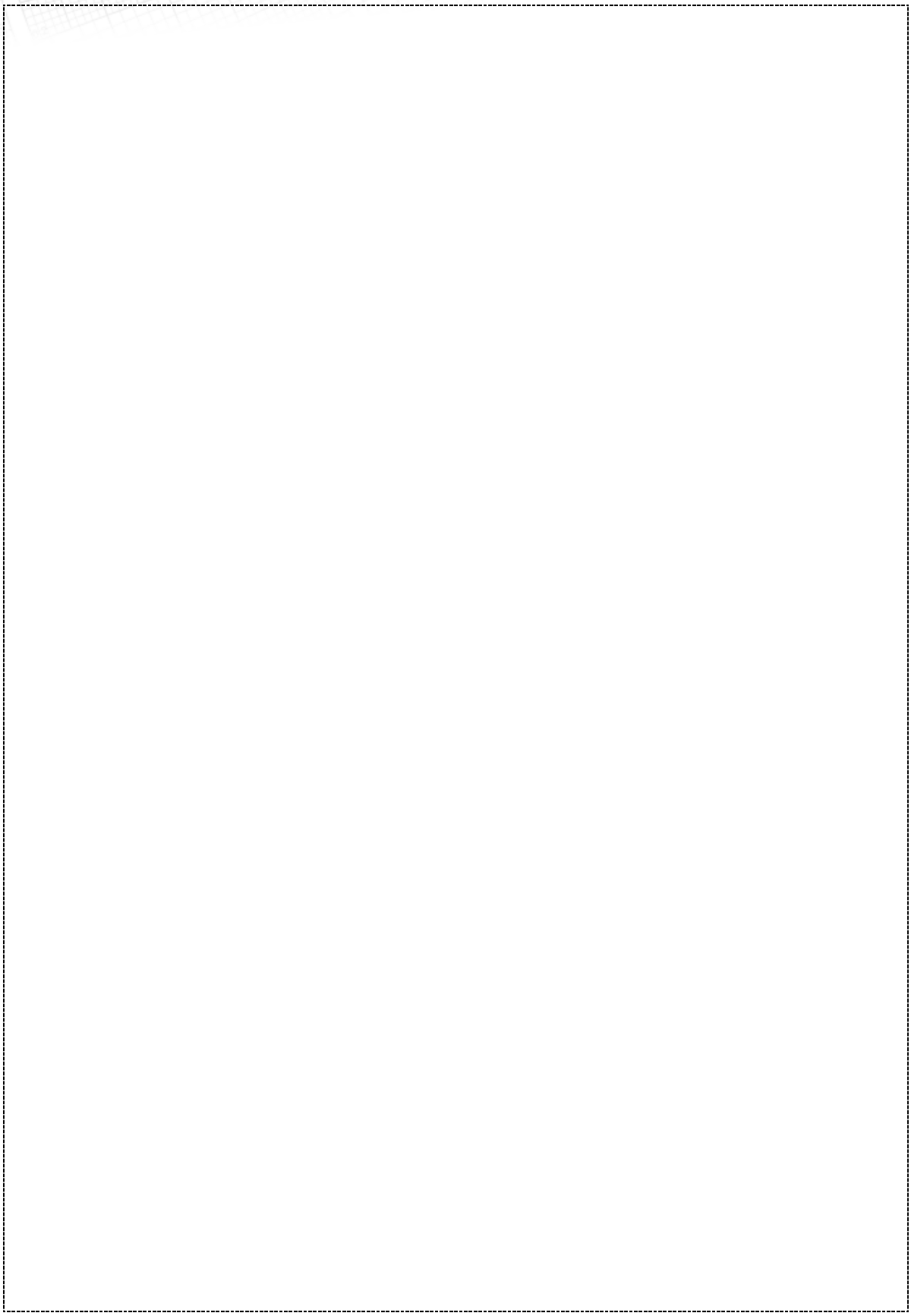

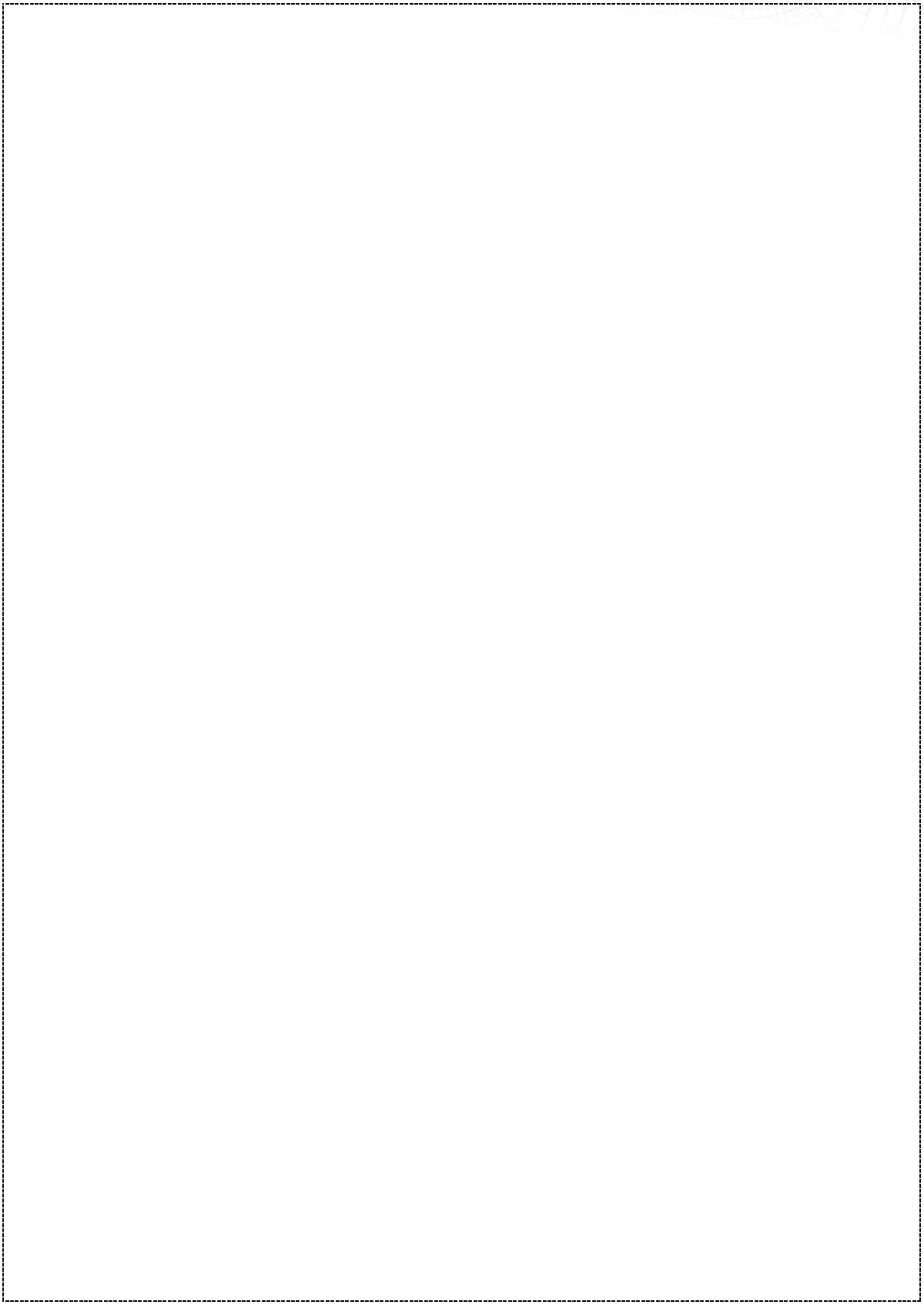

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