

2022 19th European Radar Conference (EuRAD 2022)

**Milan, Italy
28-30 September 2022**



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EuRAD01: EuRAD Opening Session

Chair: Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy

Co-Chair: Marco De Fazio, Leonardo, Italy

09:00-10:40, Wednesday 28th September 2022, Brown 3


- (NA)  **Opening of the European Radar Conference 2022**
Pierfrancesco Lombardo, EuRAD Chair
- (NA)  **Welcome Address: Opening of the European Radar Conference 2022**
Marco De Fazio, EuRAD Co-Chair
- (NA)  **A Perspective of European Space Activities**
Elena Grifoni-Winters, ESA, France
- (NA)  **Hypersonic Threat and Radar Defense**
Alfonso Farina¹, Marco Frasca², Luca Timmoneri¹
¹Leonardo, Italy; ²MBDA, Italy

EuRAD02: Automotive Radar I

Chair: Marina Gashinova, University of Birmingham, UK

Co-Chair: Willem A. Hol, Thales, The Netherlands

11:20-13:00, Wednesday 28th September 2022, Amber 5






- (NA)  **Training the Untrainable: New Concepts for Deep Learning Enhanced Automotive Radar Signal Processing (Invited Keynote)**
Martin Vossiek, Christian Schüßler, Marcel Hoffmann, FAU Erlangen-Nürnberg, Germany
- 1   **A Modulation-Based Radar Target Simulator and its Hardware Nonidealities**
Pirmin Schoeder, Arne Martin, Benedikt Meinecke, David Werbunat, Christian Waldschmidt, Universität Ulm, Germany
- 5   **SINR Improvement Across the Automotive Radar Signal Processing Chain**
Anum Pirkani, S. Pooni, S.L. Cassidy, E.G. Hoare, Y. Xiao, Mikhail Cherniakov, Marina S. Gashinova, University of Birmingham, UK
- 9   **Variable Traffic Scenario Generation for Testing Automotive Radar Sensors**
Patrick Rippl¹, Pirmin Schoeder², Timo Grebner², Christian Waldschmidt², Thomas Walter¹
¹Technische Hochschule Ulm, Germany; ²Universität Ulm, Germany
- 13   **Measurement-Based Analysis of a Non-Coherent MIMO Radar Network for Automotive Applications**
Sergio López Fernández, A. Chaminda J. Samarasekera, Reinhard Feger, Andreas Stelzer, Johannes Kepler Universität Linz, Austria

EuRAD03: Radar for Space Exploration and Remote Sensing

Chair: Willem A. Hol, Thales, The Netherlands

Co-Chair: Mikhail Cherniakov, University of Birmingham, UK

16:40–18:20, Wednesday 28th September 2022, Amber 5






- (NA)  **SAR Earth Observation for United Nations Sustainable Development Goals** (Invited Keynote)
Paolo Gamba, Fabio Dell'Acqua, Università di Pavia, Italy
- 17  **Long Baseline Radar Bistatic Measurements of Geostationary Satellites**
Sarah Welch¹, Gregory Hogan¹, Robert Morrison¹, Cees Bassa², Tonino Pisanu³
¹MIT Lincoln Laboratory, USA; ²ASTRON, The Netherlands; ³INAF, Italy
- 21  **Robust UAV-Borne Fully Digital MIMO OFDM Radar for the Generation of a Digital Elevation Model**
Felix Koderer, Benedikt Schweizer, Alexander Grathwohl, Christian Waldschmidt, Universität Ulm, Germany
- 25  **LSSC Solid-State High-Power Amplifiers**
N.D. Lopez¹, M.E. MacDonald², Mohamed D. Abouzahra²
¹BAE Systems, USA; ²MIT Lincoln Laboratory, USA
- 29  **Development of the HUSIR Dual-Band Feed**
Roy K. Lee¹, Brian Simakauskas¹, Christopher Eckert², Mohamed D. Abouzahra¹
¹MIT Lincoln Laboratory, USA; ²MIT Haystack Observatory, USA

EuRAD04: Gesture Recognition with Radar

Chair: Jungmaier Reinhard Wolfgang, Infineon Technologies, Germany

Co-Chair: Marlene Harter, Hochschule Offenburg, Germany

09:00–10:40, Thursday 29th September 2022, Amber 5







- (NA)  **Deep Learning Advances of Radar-Based Gesture Sensing** (Invited Keynote)
Avik Santra, Infineon Technologies, Germany
- 33  **Spiking Neural Networks for Gesture Recognition Using Time Domain Radar Data**
Ahmed Shaaban¹, Wolfgang Furtner¹, Robert Weigel², Fabian Lurz²
¹Infineon Technologies, Germany; ²FAU Erlangen-Nürnberg, Germany
- 37  **mm-Wave Radar Hand Shape Classification Using Deformable Transformers**
Athmanarayanan Lakshmi Narayanan¹, Asma Beevi K.T.¹, Haoyang Wu², Jingyi Ma², W. Margaret Huang¹
¹Intel, USA; ²Intel, China
- 41  **Joint Pedestrian Gesture Recognition and Orientation Estimation from Multistatic Radar Data**
Nicolai Kern, Ahmed Badr, Timo Grebner, Pirmin Schoeder, Christian Waldschmidt, Universität Ulm, Germany
- 45  **Towards Natural Virtual Mouse with mm-Wave Radar**
Haoyang Wu, Xiaodong Cai, Jingyi Ma, Xu Zhang, Intel, China

EuRAD05: EuRAD Posters

Chair: *Debora Pastina, Università di Roma "La Sapienza", Italy*






Co-Chair: *Fabrizio Santi, Università di Roma "La Sapienza", Italy*

10:40–13:00, Thursday 29th September 2022, Exhibition Hall

- 49  **C** **Mapping Error Reduction Methods for Polyphase Codes Generated by Quadrature Architectures**
Bas van de Ven¹, Daan Rosenmuller¹, Erwin Janssen², Kostas Doris¹, Georgi Radulov¹, Marion Matters-Kammerer¹
¹ Technische Universiteit Eindhoven, The Netherlands; ² NXP Semiconductors, The Netherlands
- 53  **C** **Theoretical Angular Resolution of Forward-Looking MIMO-SAR Systems**
Adnan Albaba¹, Sofie Pollin², Piet Wambacq¹, Hichem Sahli¹, André Bourdoux³
¹ Vrije Universiteit Brussel, Belgium; ² KU Leuven, Belgium; ³ imec, Belgium
- 57  **C** **Doppler Tolerant and Detection Capable Discrete Frequency-Coding Waveform Sets**
Anjali Kadambi, Hrishik Sagar, Ravi Kadlimatti, BITS Pilani, India
- 61  **C** **W-Band GB-SAR for 3D Imaging**
A. Beni, T. Consumi, L. Miccinesi, M. Pieraccini, Università di Firenze, Italy
- 65  **C** **3D SAR Imaging Radar System at Microwave Frequencies: Experimental Results**
Rupesh Kumar, Amir Masoud Molaei, Vincent Fusco, Okan Yurduseven, Queen's University Belfast, UK
- 69  **C** **Key Performance Indicators for System Analysis of MIMO Radars with Widely Separated Antennas**
G. Serafino¹, S. Maresca², M.M.H. Amir¹, A. Malacarne³, P. Ghelfi³, A. Bogoni¹
¹ Scuola Superiore Sant'Anna, Italy; ² CNR-IEIIT, Italy; ³ CNIT, Italy

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- 73  **C** **Improved TOA and Pulse Width Estimation for Wideband Signal in Electronic Warfare Systems**
Jong-Hyeon Bang, Do-Hyun Park, Hyoung-Nam Kim, Pusan National University, Korea
- 77  **C** **Time-Domain Analysis of Ultra-Wideband Scattering Properties of Fruits**
Jonas Gedschold¹, Tim Erich Wegner¹, Adam Kalisz², Reiner S. Thomä¹, Jörn Thielecke², Giovanni Del Galdo¹
¹ Technische Universität Ilmenau, Germany; ² FAU Erlangen-Nürnberg, Germany
- 81  **C** **Tailoring Radar-Based Patient Monitoring Models to Real-Life Needs Using Utility Maximization**
Louis Vincent-De Sloover, Lorin Werthen-Brabants, Geethika Bhavanasi, Tom Dhaene, Ivo Couckuyt, Ghent University, Belgium
- 85  **C** **SWALIS/KaRADOC Sensors: Calibration Procedure for Radar Systems for Hydrologic Remote Sensing Applications**
Jean-Claude Kokou Koumi¹, Stéphane Méric¹, Jordi Chinaud², Éric Pottier¹, Guy Grunfelder¹, Gil Picoult¹, Alain Mallet²
¹ IETR (UMR 6164), France; ² CNES, France
- 89  **C** **A Fast and Accurate Convolutional Neural Network for LPI Radar Waveform Recognition**
Do-Hyun Park, Jong-Hyeon Bang, Ji-Hun Park, Hyoung-Nam Kim, Pusan National University, Korea

EuRAD06: Radar-communication Waveforms and MIMO Applications

Chair: Gaspare Galati, Università di Roma "Tor Vergata", Italy

Co-Chair: David Mata-Moya, Universidad de Alcalá, Spain

14:20-16:00, Thursday 29th September 2022, Amber 1






- (NA)  **Detection and Cognitive Beamforming in Massive MIMO Radars** (Invited Keynote)
Maria Sabrina Greco, Università di Pisa, Italy
- 93  **Comparison of Radar Receivers for OFDM and OTFS Waveforms**
Aitor Correas-Serrano¹, Nikita Petrov², Maria Gonzalez-Huici¹, Alexander Yarovoy³
¹Fraunhofer FHR, Germany; ²NXP Semiconductors, The Netherlands; ³Technische Universiteit Delft, The Netherlands
- 97  **Doppler Tolerant and Detection Capable Polyphase Good Code Sets Based on Linear FM Waveforms**
Anjali Kadambi, Ravi Kadlimatti, BITS Pilani, India
- 101  **Waveform Design for Range-ISL Minimization with Spectral Compatibility in MIMO Radars**
Ehsan Raei, Mohammad Alae-Kerahroodi, Bhavani Shankar Mysore Rama Rao, Université du Luxembourg, Luxembourg
- 105  **Fast Direction of Arrival Estimation Based on Space and Frequency Multiple Division Access**
Giovanni Collodi, Stefano Maddio, Marco Passafiume, Giuseppe Pelosi, Monica Righini, Università di Firenze, Italy

EuRAD07: Passive Radar

Chair: Pietro Guccione, Aresys, Italy

Co-Chair: Krzysztof Kulpa, Warsaw University of Technology, Poland

14:20-16:00, Thursday 29th September 2022, Amber 4






- (NA)  **Passive Radar Imaging in SAR and ISAR Mode** (Invited Keynote)
Krzysztof Kulpa, Damian Gromek, Marcin Bącznyk, Piotr Samczyński, Warsaw University of Technology, Poland
- 109  **An Apodization Approach for Passive GMTI Radar with Non-Uniform Linear Arrays**
Andrea Quirini, Giovanni Paolo Blasone, Fabiola Colone, Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy
- 113  **Planar Array and Spatial Filtering Techniques for Improving DVB-S Based Passive Radar Coverage**
N. del-Rey-Maestre, M.P. Jarabo-Amores, D. Mata-Moya, A. Almodóvar-Hernández, J. Rosado-Sanz, Universidad de Alcalá, Spain
- 117  **Performance Prediction of the Loaded Reciprocal Filter for OFDM-Based Passive Radar**
Javier Trujillo Rodriguez, Fabiola Colone, Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy
- 121  **Passive Space Object Observation Using LOFAR Radio Telescope and Software-Defined Radio Receiver**
Konrad Jędrzejewski¹, Mateusz Malanowski¹, Krzysztof Kulpa¹, Piotr Krysik¹, Mariusz Pożoga²
¹Warsaw University of Technology, Poland; ²Polish Academy of Sciences, Poland

EuRAD08: Positioning Techniques for Sensor Motion Compensation and Indoor Localization

Chair: Laurent Ferro-Famil, Université de Toulouse, France

Co-Chair: Stefano Tebaldini, Politecnico di Milano, Italy

16:40–18:20, Thursday 29th September 2022, Amber 1






- (NA)  **Localization in Smart Radio Environments** (*Invited Keynote*)
Davide Dardari, Università di Bologna, Italy
- 125  **Precise Indoor Positioning with a Dodecahedron Sequential Rotation Antenna Array Designed for Space Division Multiple Access**
Giovanni Collodi, Stefano Maddio, Marco Passafiume, Giuseppe Pelosi, Monica Righini, Università di Firenze, Italy
- 129  **High Accuracy Position Calculation of a Hovering UAV Using a Rotating Radar**
Philipp Stockel¹, Patrick Wallrath¹, Nils Pohl¹, Reinhold Herschel²
¹Ruhr-Universität Bochum, Germany; ²Fraunhofer FHR, Germany
- 133  **Motion Compensation for Body-Frame Doppler Estimation of Radar Sensors on Multi-Rotor UAV Platforms**
Seongbu Hwang, Taewoo Yu, Sangwook Nam, Seoul National University, Korea
- 137  **Optimized DBSCAN with Improved Static Clutter Removal for High Resolution Automotive Radars**
Santhana Raj, Dipanjan Ghosh, PathPartner Technology, India

EuRAD09: Advanced Signal Processing Concepts for Automotive Radar

Chair: Martin Vossiek, FAU Erlangen-Nürnberg, Germany

Co-Chair: Marina Gashinova, University of Birmingham, UK

16:40–18:20, Thursday 29th September 2022, Amber 2






- (NA)  **Automotive Radar — Modern Trends and Challenges in Signal Processing** (*Invited Keynote*)
Marina S. Gashinova, University of Birmingham, UK
- 141  **Automotive Object Detection on Highly Compressed Range-Beam-Doppler Radar Data**
Michael Meyer¹, Sherif Nekkah¹, Georg Kusch¹, Sven Tomforde²
¹Cruise, Germany; ²CAU, Germany
- 145  **Complex-Valued Neural Networks for Millimeter Wave FMCW-Radar Angle Estimations**
Kevin Kaiser¹, Jonas Daugalas², Javier López-Randulfe², Alois Knoll², Robert Weigel¹, Fabian Lurz³
¹FAU Erlangen-Nürnberg, Germany; ²Technische Universität München, Germany; ³Technische Universität Hamburg, Germany
- 149  **Analysis of a Machine Learning Based Virtual Array Augmentation Technique for Automotive Radar**
Maximilian Eschbaumer, Simon Achatz, Gabor Balazs, Infineon Technologies, Germany
- 153  **Range-Angle Coupling Compensation in Frequency Domain Interleaved OFDM MIMO Systems**
Adham Sakhnini¹, André Bourdoux², Mamoun Guenach², Hichem Sahli², Sofie Pollin¹
¹KU Leuven, Belgium; ²imec, Belgium

EuRAD10: Automotive Radar III

Chair: André Bourdoux, imec, Belgium

Co-Chair: Alessio Filippi, NXP Semiconductors, The Netherlands

16:40–18:20, Thursday 29th September 2022, Amber 4

- (NA)  **Digitally Modulated Radars for Automotive Applications** (*Invited Keynote*)
André Bourdoux, Marc Bauduin, imec, Belgium
- 157  **6D Self-Calibration of the Position and Orientation of Radar Sensors in a Radar Network**
Timo Grebner, Matthias Linder, Nicolai Kern, Pirmin Schoeder, Christian Waldschmidt, Universität Ulm, Germany
- 161  **Automotive Radar Parameter Estimation for Cognitive Interference Mitigation**
Anum Pirkani, Fatemeh Norouzian, Mikhail Cherniakov, Marina S. Gashinova, University of Birmingham, UK
- 165  **High Bandwidth and Low Phase Noise Architecture for Multi-Mode 60/77GHz FMCW Radars**
Karthik Subburaj¹, Sandeep Rao¹, Samala Sreekiran², Anil Mani¹, Brian Ginsburg², Karthik Ramasubramanian¹
¹Texas Instruments, India; ²Texas Instruments, USA
- 169  **A 94GHz Antenna On-Silicon Interposer with Parasitic Elements for Bandwidth Improvement**
Juan C. Garcia-Santos¹, Bart Nauwelaers¹, Guy A.E. Vandenbosch¹, Siddhartha Sinha², Bivragh Majeed², Evgenii Novoselov², Ilja Ocket²
¹KU Leuven, Belgium; ²imec, Belgium

EuRAD11: Human Activities with Radar

Chair: Nils Pohl, Ruhr-Universität Bochum, Germany

Co-Chair: Kevin Chetty, University College London, UK

16:40–18:20, Thursday 29th September 2022, Amber 5






- (NA)  **Radar Approaches for Sequential Human Activity Classification** (*Invited Keynote*)
Francesco Fioranelli, Nicolas Kruse, Ronny Gerhard Guendel, Alexander Yarovoy, Technische Universiteit Delft, The Netherlands
- 173  **Quantifying Uncertainty in Real Time with Split BiRNN for Radar Human Activity Recognition**
Lorin Werthen-Brabants, Geethika Bhavanasi, Ivo Couckuyt, Tom Dhaene, Dirk Deschrijver, Ghent University, Belgium
- 177  **MIMO Differential Radar Using Null Point Beams for Vital Sign Detection in the Presence of Body Motions**
Kawon Han, Songcheol Hong, KAIST, Korea
- 181  **Contact-Free Pedestrian Tracking Using Massive MIMO-OFDM Communication System**
Chenglong Li¹, Sibren De Bast², Yang Miao², Emmeric Tanghe¹, Sofie Pollin², Wout Joseph¹
¹Ghent University, Belgium; ²KU Leuven, Belgium
- 185  **A Compact Harmonic Radar System at 61/122GHz ISM Band for Physiological Joint Angle Estimation**
Alexander Orth¹, Patrick Kwiatkowski¹, Steffen Hansen², Katharina Müller³, Francisco Geu Flores³, Falko Heitzer³, Constantin Mayer³, Marcus Jäger³, Andreas Prokscha⁴, Nils Pohl¹
¹Ruhr-Universität Bochum, Germany; ²Fraunhofer FHR, Germany; ³Universität Duisburg-Essen, Germany; ⁴ID4us, Germany

EuRAD12: Signal Processing and Machine Learning for Radar Applications

Chair: Francesco Fioranelli, Technische Universiteit Delft, The Netherlands

Co-Chair: Mohammed Jahangir, University of Birmingham, UK

09:00-10:40, Friday 30th September 2022, Amber 1


- (NA)  **Neural Network Architecture for Classification and Typing of Air Targets** (*Invited Keynote*)
Massimo Loffreda, Luca Timmoneri, Pasquale Ferrara, Marina Carnemolla, Gabriele Gennaro, Bruno Parisi, Marco Aragri, Alfonso Farina, Leonardo, Italy
- 189  **Low-Latency Convolutional Neural Network for Classification of Previously Unseen Drone Types**
Bashar I. Ahmad¹, Jonathan Grey², Mike Newman², Stephen Harman¹
¹Aveillant, UK; ²Thales, UK
- 193  **Unknown Object Recognition Using the Manifold Structure of Class Distributions**
Ryoma Yataka, Masashi Shiraishi, Mitsubishi Electric, Japan
- 197  **Fast and Resource-Efficient CNNs for Radar Interference Mitigation on Embedded Hardware**
Michael Hirschmugl¹, Johanna Rock¹, Paul Meissner², Franz Pernkopf¹
¹Technische Universität Graz, Austria; ²Infineon Technologies, Austria
- 201  **An Iterative Channel Imbalance Online Calibration Technique for Automotive Radar**
Simon Achatz¹, Mayeul Jeannin¹, Maximilian Eschbaumer¹, Farhan B. Khalid¹, Dian Tresna Nugraha², André Roger¹
¹Infineon Technologies, Germany; ²Infineon Technologies, Indonesia

EuRAD13: Radar Imaging

Chair: Jacco de Wit, TNO, The Netherlands

Co-Chair: Michael Antoniou, University of Birmingham, UK

09:00-10:40, Friday 30th September 2022, Amber 2






- (NA)  **Radar Imaging for Land Monitoring, Science, and Safety** (*Invited Keynote*)
Stefano Tebaldini, Andrea Monti Guarnieri, Claudio Maria Prati, Politecnico di Milano, Italy
- 205  **Tomographic Processing of Bistatic Airborne SAR Data from the TomoSense Campaign**
Mauro Mariotti d'Alessandro, Stefano Tebaldini, Politecnico di Milano, Italy
- 209  **3D SAR Imaging Using Bistatic Opposite Side Acquisitions, the Bizona Concept**
Laurent Ferro-Famil¹, Stefano Tebaldini², Ray Abdo³, Lekhmissi Harkati⁴, Mengda Wu³
¹Université de Toulouse, France; ²Politecnico di Milano, Italy; ³IETR (UMR 6164), France; ⁴École Militaire Polytechnique, Algeria
- 213  **Geometrical Shapes Detection in High-Resolution THz SAR Image**
Aman Batra¹, Michael Wiemeler¹, Diana Göhringer², Thomas Kaiser¹
¹Universität Duisburg-Essen, Germany; ²Technische Universität Dresden, Germany
- 217  **Investigation of Error and Noise Effects in Irregular Near-Field Imaging via the Multi-Level Fast Spectral Domain Algorithm**
Matthias M. Saurer, Thomas F. Eibert, Technische Universität München, Germany

EuRAD14: mm-Wave and Imaging Radar

Chair: Mayazzurra Ruggiano, Thales, The Netherlands

Co-Chair: Nils Pohl, Ruhr-Universität Bochum, Germany

09:00-10:40, Friday 30th September 2022, Amber 3






- (NA)  **Recent Advances in Short-Range Radar Cross-Range Resolution Improvement** (*Invited Keynote*)
Alexander Yarovoy, Technische Universiteit Delft, The Netherlands
- 221  **A 77-81GHz FMCW MIMO Radar with Linear Virtual Array Enabling 3D Target Localization by Use of Frequency-Steered TX Antennas**
Patrick Kwiatkowski, Alexander Orth, Lukas Piotrowsky, Nils Pohl, Ruhr-Universität Bochum, Germany
- 225  **Millimeter-Wave Imaging Using Dielectric Lens for Security Application**
Arie Setiawan¹, Atsuki Yamawaki¹, Naruto Yonemoto², Hitoshi Nohmi³, Hiroshi Murata¹
¹Mie University, Japan; ²MPAT, Japan; ³Alouette Technology, Japan
- 229  **Material Characterization Using High-Resolution Multiple-Input Multiple-Output Imaging Radars**
Marius Brinkmann, Frank Gumbmann, Gerhard F. Hamberger, Benedikt Simper, Rohde & Schwarz, Germany
- 233  **Computational Microwave Imaging Based on a Single Electric-Field Scan**
Rupesh Kumar, Guillermo Álvarez-Narciandi, Maria Garcia-Fernández, Vincent Fusco, Okan Yurduseven, Queen's University Belfast, UK

EuRAD15: Radar Phenomenology and Calibration

Chair: Stephane Meric, IETR (UMR 6164), France

Co-Chair: Alexander Kölpin, Technische Universität Hamburg, Germany

09:00-10:40, Friday 30th September 2022, Amber 4

- (NA)  **Traveling Wave Josephson Parameter Amplifiers (TWJPAs) Technology with Application to Microwave Quantum Radar** (*Invited Keynote*)
Patrizia Livreri¹, Alfonso Farina²
¹Università di Palermo, Italy; ²Leonardo, Italy
- 237  **An Iterative Phase Shifters Online Calibration Technique for Automotive Radar Systems**
Mayeul Jeannin¹, Oliver Lang², Dian Tresna Nugraha³, Farhan Bin Khalid¹, Simon Achatz¹, André Roger¹, Mario Huemer²
¹Infineon Technologies, Germany; ²Johannes Kepler Universität Linz, Austria; ³Infineon Technologies, Indonesia
- 241  **Effects of Bistatic Operation in Harmonic Radar**
Anastasia Lavrenko, Universiteit Twente, The Netherlands
- 245  **A Broadband Test Environment Concept for FMCW Radars Based on Overmoded Waveguides**
Manuel Funk, Christoph Dahl, Jan Barowski, Ilona Rolfes, Christian Schulz, Ruhr-Universität Bochum, Germany
- 249  **Design of a High Linear, Frequency Selective VHF-Receiver with Low Phase Noise for a Passive Radar System**
Marie Horlbeck¹, Stefan Erhardt¹, Robert Weigel¹, Fabian Lurz²
¹FAU Erlangen-Nürnberg, Germany; ²Technische Universität Hamburg, Germany

EuRAD16: Focussed Session Automotive Radars Above 100 GHz

Chair: André Bourdoux, imec, Belgium

Co-Chair: Alessio Filippi, NXP Semiconductors, The Netherlands

11:20-13:00, Friday 30th September 2022, Amber 1


- 253   **Spectrum for Automotive Radar in the 140GHz Band in Europe**
Alessio Filippi¹, Vincent Martinez², Marnix Vlot¹
¹NXP Semiconductors, The Netherlands; ²NXP Semiconductors, France
- 257   **Comparative Study of Automotive MIMO Radar Measurements in W-Band and D-Band**
Jonas Wagner, Christoph Dahl, Ilona Rolfes, Jan Barowski, Ruhr-Universität Bochum, Germany
- 261   **Sub-THz Radar Imagery for Automotive Application**
L. Daniel, Marina S. Gashinova, University of Birmingham, UK
- 265   **Synthetic Aperture Terahertz Imaging with an Optoelectronic FMCW Radar**
Andreas Keil¹, Shiva Mohammadzadeh¹, Lars Liebermeister², Lauri Schwenson², Björn Globisch², Fabian Friederich¹
¹Fraunhofer ITWM, Germany; ²Fraunhofer HHI, Germany
- 269   **Radar Cross-Section Characterization of the Car In-Cabin Environment at Sub-THz Frequencies**
Victor Pettersson¹, Sining An²
¹Veoneer, Sweden; ²Chalmers University of Technology, Sweden

EuRAD17: Array Techniques and Direction Finding

Chair: Michael Antoniou, University of Birmingham, UK

Co-Chair: Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy

11:20-13:00, Friday 30th September 2022, Amber 2






- (NA)  **From Phased Arrays, Through Digital Beamforming, to Fully Digital Arrays for Radar**
(Invited Keynote)
Laura Anitori, TNO, The Netherlands
- 273   **Circular Convolutional Learned ISTA for Automotive Radar DOA Estimation**
Jihwan Youn¹, Satish Ravindran², Ryan Wu², Jun Li², Ruud van Sloun¹
¹Technische Universiteit Eindhoven, The Netherlands; ²NXP Semiconductors, USA
- 277   **Filter-Bank-Enabled Leaky-Wave Antenna Array Technique for Full-Band-Locked Radar System in Stitched Frequency-Space Domain**
Dongze Zheng, Ke Wu, Polytechnique Montréal, Canada
- 281   **Using Widely Separated MIMO Antennas for UAV Radar Direction-of-Arrival Estimation**
Max Schurwanz¹, Silas Oettinghaus², Jan Mietzner¹, Peter Adam Hoehner²
¹HAW Hamburg, Germany; ²CAU, Germany
- 285   **Improved Direction Finding Accuracy for a Limited Number of Antenna Elements with Harmonic Characteristic Analysis**
Sen Yuan, Francesco Fioranelli, Alexander Yarovoy, Technische Universiteit Delft, The Netherlands

EuRAD18: mm-Wave and Broadband Radar Subsystems

Chair: Stephen Harman, Aveillant, UK

Co-Chair: Mohammed Jahangir, University of Birmingham, UK

11:20-13:00, Friday 30th September 2022, Amber 3






- (NA)  **Wide Band Antenna Systems for Space-Based Radar** (*Invited Keynote*)
Pasquale Capece, Thales, Italy
- 289  **A Low Phase Noise 77GHz Frequency Synthesizer for Long Range Radar**
Stephan Kruse¹, Meysam Bahmanian¹, Saeed F. Fard¹, Marc-Michael Meinecke², Heiko G. Kurz², J. Christoph Scheytt¹
¹Universität Paderborn, Germany; ²Volkswagen, Germany
- 293  **Frequency-Beam-Scanning mm-Wave Antennas for Direction Finding RADAR**
Miguel Poveda-García¹, Alejandro Gil-Martínez¹, Francisco Salmerón², José Luis Gómez-Tornero¹
¹Universidad Politécnica de Cartagena, Spain; ²A4Radar, Spain
- 297  **Algorithmic Radar, a Novel Low-Power Architecture for High-Accuracy PCW Radar**
Cornelis A.H.M. van Puijenbroek¹, Thomas B.N. Booij¹, Vojkan Vidojkovic¹, Christian Fager², Rob Maaskant², Peter G.M. Baltus¹
¹Technische Universiteit Eindhoven, The Netherlands; ²Chalmers University of Technology, Sweden
- 301  **Concepts for SAR Systems with Photonic Beamforming**
Josef Ydreborg, Sigurd Huber, Gerhard Krieger, DLR, Germany

EuRAD19: Radar Modules and Systems

Chair: Nils Pohl, Ruhr-Universität Bochum, Germany

Co-Chair: Jan Wessel, Fraunhofer FHR, Germany

11:20-13:00, Friday 30th September 2022, Amber 4

- (NA)  **126-182GHz D-Band Radar: Hardware and Applications** (*Invited Keynote*)
Timo Jaeschke¹, Simon Küppers¹, Jan Barowski², Nils Pohl²
¹2 π -LABS, Germany; ²Ruhr-Universität Bochum, Germany
- 305  **77GHz 4×4 TDM MIMO Radar with an Extended Unambiguous Velocity Range**
Juergen Hasch, Martin Fink, Tobias Schmid, Robert Bosch, Germany
- 309  **High-Performance Miniaturized Quad T/R Module for X-Band Low-Profile AESA**
Emrah Koç, Nihan Öznazlı, Firat Altuntaş, Aselsan, Türkiye
- 313  **An S Band Tile of 16 T-R Modules for Fully Digital Array (DAR Technology)**
F. Macro, M. Di Battista, B. Buccinnà, VirtuaLabs, Italy
- 317  **Circularly Polarized Phased Array System with Pattern Optimization Algorithm for Low Side Lobe Level and Scanning Axial Ratio**
Jeong-Wook Kim, Hyo-Won Lee, Sol Kim, Sang Hyuck Han, Ji-Hoon Lee, Jong-Won Yu, KAIST, Korea

EuRAD20: EuRAD Closing Session

Chair: *Debora Pastina, Università di Roma "La Sapienza", Italy*

Co-Chair: *Fabiola Colone, Università di Roma "La Sapienza", Italy*

14:20-16:00, Friday 30th September 2022, Brown 1-2

- (NA)  **EuRAD Closing Session Welcome**
Debora Pastina, Fabiola Colone, EuRAD TPC Chair
- (NA)  **Space Based Radar Architectures and Technologies from Very High Spatial Resolution to Constellation for High Revisit: Status and Perspectives**
Giampiero Di Paolo, Thales, Italy
- (NA)  **EuRAD Awards Ceremony**
Giuseppe Macchiarella, EuMW 2022 Awards Chair
- (NA)  **EuRAD Closing Remarks**
Pierfrancesco Lombardo, EuRAD 2022 Chair
- (NA)  **Invitation to EuRAD 2023**
Christian Waldschmidt, EuRAD 2023 Chair

EuMC/EuRAD01: Automotive Radar II

Chair: *Thomas Zwick, KIT, Germany*

Co-Chair: *Kevin Cinglant, ZF Group, France*

14:20-16:00, Wednesday 28th September 2022, Amber 5


- (NA)  **Status and Trends in Automotive Radars (Invited Keynote)**
Marlene Harter, Hochschule Offenburg, Germany
- 321   **Instantaneous Ego-Motion Estimation Using a Coherent Radar Network**
Marcel Hoffmann¹, Lena Krabbe¹, Christian Schüßler¹, Peter Gulden², Martin Vossiek¹
¹FAU Erlangen-Nürnberg, Germany; ²indie Semiconductor, Germany
- 325   **Doppler Beam Sharpening for High-Resolution Imaging in Dynamic Automotive Scenes**
S.L. Cassidy, S. Pooni, Anum Pirkani, E.G. Hoare, Mikhail Cherniakov, Marina S. Gashinova, University of Birmingham, UK
- 329   **Influence of Ramp Timing Dither on Modulation-Based Radar Target Simulators**
Pirmin Schoeder, Vinzenz Janoudi, Timo Grebner, Arne Martin, Christian Waldschmidt, Universität Ulm, Germany
- 333   **Non-Invasive Axle-Based Vehicle Classification Utilising Tracking Radar Technology**
V.R.J. Deville¹, C.M. Lievers², J.H. Manton¹
¹University of Melbourne, Australia; ²Sensys Gatso Group, The Netherlands

EuMC/EuRAD02 : Novel Antennas for Space Applications

Chair: Piero Angeletti, ESA-ESTEC, The Netherlands

Co-Chair: Stefania Monni, TNO, The Netherlands

16:40-18:20, Wednesday 28th September 2022, Amber 2







- (NA)  **Antennas for Space: Recent European Developments and Trends** (Invited Keynote)
Peter de Maagt, Salvatore D'Addio, Natanael Ayllon, Piero Angeletti, ESA-ESTEC, The Netherlands
- (NA)  **Low-Profile Highly Directive 2D-Beam-Steering Antenna in Ka-Band with 3D-Printed All-Dielectric Sub-Wavelength Deflectors**
Thi Quynh Van Hoang, Matthieu Bertrand, Erika Vandelle, Brigitte Loiseaux, Thales, France
- (NA)  **Numerical Investigation About the Impact of Struts on the European Space Agency Deep Space Antennas Efficiency and Sidelobes**
D. Arenare¹, F. Pelorossi², F. Concaro², Marco Pasian¹
¹Università di Pavia, Italy; ²ESA-ESOC, Germany
- (NA)  **A Mechanically Steered Antenna Using a Moving Part Based on Gap Waveguide**
Bertrand Boin, Agnès Lesure, Thales, France
- (NA)  **Link Budget and Design Approach of a Non-Terrestrial 5G Automotive Antenna**
Umair Tayyab¹, Hans-Peter Petry², Ashish Kumar¹, Md. Golam Robbani¹, Thomas Wack³, Matthias A. Hein¹
¹Technische Universität Ilmenau, Germany; ²DeSK, Germany; ³Wiegand, Germany

EuMC/EuRAD03 : EuMC/EuRAD Posters











Chair: Fabiola Colone, Università di Roma "La Sapienza", Italy

Co-Chair: Nicolò Delmonte, Università di Pavia, Italy

16:00-18:20, Wednesday 28th September 2022, Exhibition Hall

- (NA)  **Increased Coding Capacity of Chipless RFID Tags Using Radiation Pattern Diversity**
Florian Requena, Nicolas Barbot, Darine Kaddour, Etienne Perret, LCIS (EA 3747), France
- (NA)  **A Multicarrier Communication Method to Increase Radio Coverage for UHF RFID**
Jasmin Walk¹, Martin Maderboeck¹, Georg Saxl¹, Manuel Ferdik², Moritz Fischer¹, Thomas Ussmueller¹
¹Universität Innsbruck, Austria; ²MCI, Austria
- (NA)  **Antenna Design for 5G-Based Train-Centric Control System**
Dong-Jin Lee¹, Sang-Jin Oh², In-June Hwang³
¹KRRI, Korea; ²C to C tech, Korea; ³KRISS, Korea
- (NA)  **Analysis of Onboard Channel Measurements for Train Communication Scenarios in the Context Towards 6G Enabling Technologies**
Johann Lichtblau¹, Kariem Elkholy², Alexander Koelpin¹
¹Technische Universität Hamburg, Germany; ²FAU Erlangen-Nürnberg, Germany
- (NA)  **A Standalone 5G Industrial Testbed Design Considerations for Industry 4.0**
Ying Rao Wei, Anil S. Keshavamurthy, Ralph Wittmann, Antonio R. Zahonero, Intel, Germany
- (NA)  **Multi-Hole Waveguide Directional Coupler Design via Brick-Based Microwave Design Methodology**
Sefa Erdogan¹, Anil Arici¹, Umut Bulus¹, Huseyin Aniktar²
¹Antenom Antenna Technologies, Türkiye; ²TÜBİTAK BİLGEM, Türkiye

EuMC/EuRAD03 continued...

- 377   **Hybrid Mechanical/Electrical Steering Antenna: Concept, Design and First Mockup**
Benoît Lesur¹, Anaël Lohou¹, Fabien Péleau¹, Alain Karas¹, Romain Contreres²
¹Safran Data Systems, France; ²CNES, France
- 381   **2D Virtual Array Techniques for MIMO Radar**
H. Yamada¹, T. Kato¹, H. Mori²
¹Niigata University, Japan; ²Toshiba, Japan
- 385   **Quasi-Monostatic Antenna Displacement in Radar Target Simulation**
Axel Diewald, Benjamin Nuss, Thomas Zwick, KIT, Germany
- 389   **Human Interpretable Radar Through Deep Generative Models**
Nir Dvorecki, Yuval Amizur, Leor Banin, Mobileye, Israel
- 393   **Sensing Performance of Different Codes for Phase-Coded FMCW Radars**
Utku Kumbul¹, Nikita Petrov², Cicero S. Vaucher², Alexander Yarovoy¹
¹Technische Universiteit Delft, The Netherlands; ²NXP Semiconductors, The Netherlands