Ivan Russo
(Huawei)

"Recent applications of radars in automotive and autonomous driving"

Abstract. Advanced Driver-Assistance Systems (ADASs) and Autonomous Driving have the objective of increasing to the top the level of safety of pedestrians and drivers while providing an optimized traffic and minimizing pollution due to traffic congestions. Several automatic functions include debris detection, collision avoidance, cruise control, bridge detection, blind spot detection, road mapping and imaging, assisted parking, automatic cruise control, etc. Those safety functions, implemented by an automatic apparatus, would solve the problem of long reaction time and uncertainty that are typical of conventional unassisted vehicles, which in turn fully rely on the human driver control.
ADAS or AD systems are generally represented by groups of heterogeneous electronic + software technologies that involve sensors (cameras, radars, lidars, IMUs, navigation sensors, etc.) and other technologies to enable intra-vehicular and inter-vehicular communications (communication antennas and modules, protocols, etc.). In this seminar the focus is put on automotive radars, which represent a fundamental element since they provide sufficiently good resolutions, cost-effectiveness, and capability of operating in bad weather conditions. The main radar concepts are provided as well as the comparison between different chipset technologies including considerations on noise and its impact to the radar performances.

Short biography. Ivan Russo was born in Vibo Valentia, Italy, in 1982. He received the B.Sc. degree in electronics engineering and the M.Sc. degree in telecommunications engineering from the University of Calabria, Rende, Italy, in 2003 and 2007, respectively, and the Ph.D. degree in electronics engineering from the Mediterranean University of Reggio Calabria, Reggio Calabria, Italy, in 2011, with a focus on quasi-optical (QO) amplifiers, active FSSs, and efficient array beamforming networks. From 2010 to 2011, he was with the Department of Microwave Technology, University of Ulm, Ulm, Germany, where he was involved in high-resolution near-field probes and characterization of overmoded waveguides. From 2011 to 2013, he was a University Assistant with the Institute for Microwave and Photonics Engineering, TU Graz, Graz, Austria, where he was involved in spherical near/far-field transformations, RFID antennas, and circularly and dual-polarized UWB antennas. From 2013 to 2014, he was an EMC/Antenna Engineer with Thales Alenia Space, Turin, Italy, where he was involved in installed antenna performance on satellites. From 2014 to 2018, he was an Antenna Engineer with Elettronica S.p.A., Rome, Italy, where he focused on the development of UWB antennas and phased arrays for electronic warfare applications. Since 2018, he has been with the Huawei Research Center, Milan, Italy, as an Principal Antenna Engineer, where he is currently focusing on innovative automotive radar antennas and systems and advanced solution for phased arrays and high-speed interconnects at sub-THz.

Giovanni Antonio Salvatore
(Università Ca' Foscari Venezia)

"Multi-physics simulations for WBG power module optimization"

Abstract. WBG semiconductors (i.e. SiC and GaN) outperform silicon in terms of breakdown field (x10 in case of SiC) and thermal conductivity (x2 in case of SiC), hence, ensuring smaller conduction losses and better heat dissipation combined with faster switching frequency. All this results in saving energy (i.e. smaller battery) and costs (i.e. smaller passive components and volume of the power module) and are inducing all e-vehicles manufacturers to switch from Si IGBTs to SiC or GaN MOSFETs. However, to take fully advantage of WBG semiconductors it is of paramount importance to: (i) optimize the packaging and the thermo-electric design of the module; (ii) optimize the electromagnetic design (i.e. stray inductance and mutual coupling) to ensure clean and fast switching of the MOSFETs to avoid oscillations. This tutorial will start from basic concepts of power module design by taking an half-bridge topology as reference and will show some of the tools and methodologies that are currently used for the optimization.

Short biography. Dr. Giovanni A. Salvatore is an Assistant Professor at University of Venice Ca Foscari since July 2021. He got his bachelor in Electronics and Master in Micro&Nanotechnology from the Polytechnic of Turin in 2004 and 2006, respectively. He received the PhD in 2011 from EPFL for his research on ferroelectric transistors for memory and switch application. His doctoral dissertation was awarded the 2012 ABB Award. From 2011 to 2017 he has worked at ETH Zurich and at UIUC (Rogers' group) as senior researcher and group leader with focus on thin film electronics, wireless epidermal devices and dissolvable electronic components. At the end of 2017 he joined the ABB Corporate Research Center in Baden (CH) to work on packaging and reliability of electric devices. He is author of more than 100 peer reviewed publications and about 10 patents. His current interests fall into the concept of "sustainable electronics" with examples in biodegradable materials and devices and in efficient power converters.

Valerio Nasone
(Ferrari SpA)

"Automotive electronics: applications, challenges and opportunities for car manufacturers"

Abstract. Electronics in the automotive field is getting more and more relevance and importance: vehicle manufacturers are facing very complex systems in their applications, having to ensure challenging performance and an ever-increasing level of integration. Complexity of the electronic systems, short time to market, many possible customizations, make testing and validation at the vehicle level extremely complicated. For this reason, the manufacturing for automotive grade is subject to a dedicated validation flow and specific requirements, not only for the products but also for the processes and business organizations. All the carmakers share applications, challenges and opportunities related to the technological transition underway for electrification of the vehicles. In Ferrari, these concepts are pushed to the extremes, taken beyond the limits, to guarantee not only the maximum performance with the cutting-edge technologies, but also because they must generate the thrills that make unique the driving experience of a vehicle produced in Maranello.

Short biography. Valerio Nasone received the B.Sc. (2009) and M.Sc. (2011), both cum laude, in Electronic Engineering from the Mediterranea University of Reggio Calabria. After spending the first few years in the household appliances industry, working for the R&D department of Whirpool, he moved to the automotive field collecting important experiences within the Quality and Supplier Development of different companies such as: Fiat Chrysler Automobiles, Eldor Corporation, Ferrari Spa. Since 2018 he has been with Ferrari as Electric, Electronic & Electrification Quality Project Responsible, where he is focusing on the development and application of innovative components for hybrid and full electric vehicle architectures.

Francesco Rundo
(ST)

Carmelo Pino
(ST)

"Artificial intelligence systems for advanced predictive reliability of SiC power devices"

Abstract. In the recent years, there is much talk of artificial intelligence theory as a powerful predictive methodology with applications ranging from the field of information technology to the field of medicine, electronics, finance, etc. In this contribution the invited speakers will show the possible applications of artificial intelligence (including machine learning, deep learning and perceptive learning) in the electronics field with a special focus on the power electronics application in the latest generation electric car. From system control to driver monitoring to self-driving cars, artificial intelligence systems have significantly revolutionized this strategic market for the world economy. In this talk, the speakers will first introduce the artificial intelligence systems that are mostly used in this field and some of which were patented within the research and development activity of STMicroelectronics. Therefore, they will show the innovative applications in the automotive sector currently under development both as a product and as a prototype in the context of advanced research programs. The showed applications will preliminarily concern the system part of the latest generation car (driver assistance systems, driving scenario understanding, intelligent computer vision in electric car) and then move on to engine control and control of the power devices (silicon and silicon-carbide power mos, MCUs, etc..). Some advanced modeling and lifetime prediction / health monitoring activities of power devices currently undergoing research and development in STMicroelectronics for both silicon devices and Silicon Carbide-based technologies will be described. Finally, an overview of advanced methodologies for predictive reliability of such power devices, currently under study at STMicroelectronics R&D in Catania, will be showed.

Short biography. Francesco Rundo (M'74) is a Senior Technical Staff Team Leader at STMicroelectronics of Catania. He is a member of the Automotive R&D Power and Discretes Division of STMicroelectronics. He received his degree in Computer Science Engineering in 2000 and Ph.D. in "Applied Mathematics for Technology" from the University of Catania. He is currently team leader of the "Artificial Intelligence for Advanced Modeling and Predictive Reliability Team" at STMicroelectronics of Catania. He is currently responsible/researcher of several funded (both National and EU) research projects in the field of AI solutions for automotive/industrial applications. He has co-authored about 100 contributions in international journals, conference proceedings, book/chapters, posters, abstracts, reports. He serves as Reviewer and Guest Editor of several special issues organized by such key-editors in the field of Computer Science such as Springer, Elsevier, Frontiers, MDPI. He serves as Associate Editor for IET Networks, Applied Computational Intelligence and Soft Computing journal as well as Associate Research-Topic Editor for Frontiers in Computer Science and Neuroinformatics journals and Topic Editor for Electronics and Drones journals. He is a member of the Computer Science Ph.D. Committee at the Department of Mathematics and Computer Science of the

University of Catania as well as for in the scientific board of the National Ph.D. Program of Artificial Intelligence. He teaches several Ph.D. courses in the field of deep learning for automotive and industrial applications. He is also co-inventor of several international patents as well as member of several international conference program committees, chair and special sections chair. His main research interests include advanced bio-inspired models, advanced and perceptual deep learning, embedded systems for deep learning algorithms, advanced deep learning and mathematical modeling for automotive and power electronics, industrial and healthcare fields.

Short biography. Carmelo Pino is member of Artificial Intelligence for Modeling and Predictive Reliability Team in STMicroelectronics (ADG - R&D Power and Discretes) where he works as Advanced Research Senior Engineer. He worked as research assistant at the University of Catania, Italy, where he completed his Master's degree and Ph.D. studies. From 2014 and currently is member of the Pattern Recognition and Computer Vision Laboratory at the University of Catania and from 2020 to 2022 has been a research assistant at INAF (The National Institute for Astrophysics), Catania, Italy. His research interests include the areas of artificial intelligence applied to medical data processing, detection and segmentation in endoscopic video imaging systems, visual-knowledge ontology modelling, processing of radio-astronomical images, temporal series analysis, etc.

Michele Calabretta
(ST)

Alessandro Sitta
(ST)

"Experimental and Numerical assessment on SiC Power Module Reliability"

Abstract. Silicon carbide (SiC) power modules are currently spreading in automotive market thanks to the superior electric and thermal properties of SiC devices with respect than their silicon counterparts. This technology improves vehicle performance and efficiency, employing at the same time more compact electric components and a lighter battery pack. Nevertheless, SiC power module shall be able to fully exploit device capability during the entire product mission profile. In this contribution, an overview of reliability concerns related to SiC power module is provided. Then, some experimental and numerical methodologies, aimed to optimize this aspect, are presented. These techniques analyze different physical domain (electric, thermal, mechanical) and can give support during the entire product development.

Short biography. Michele Calabretta received the M.S. degree in mechanical engineering in 2005 and the PhD in 2009, degree in Mathematics Applied to Engineering, both at University of Catania, Catania, Italy. From 2005 to 2008, he was an R&D Engineer at Ferrari S.p.A, Maranello, Italy and later a simulation team leader, from 2008 to 2011, at Automobili Lamborghini, Sant'Agata Bolognese, Italy. He has been involved in design and multi-physics simulation (CAD/CAE) and material characterization. Since 2011, he has been in STMicroelectronics, Catania, where is currently role is Back-End Advanced Reliability & Physical Analysis Sr. Manager within the R&D Department of the Automotive and Discrete Group (ADG). His research interest includes semiconductor packaging and reliability aspects, lifetime modeling, physical analysis and multi-physics simulations.

Short biography. Alessandro Sitta received the M.S. degree in mechanical engineering and the Ph.D. degree in system, energetic, computer and telecommunication engineering from the University of Catania, Italy, in 2016 and 2021, respectively. Since 2017, he has been a Research Engineer with the Automotive and Discrete Group, Research and Development Department, STMicroelectronics, Catania, Italy. His research interests include power semiconductor device thermo-mechanical modeling, reliability estimation, and material and device experimental characterization.

Massimo Iaculo
(Micron)

"Semiconductor Memory Systems for the Automotive CASE"

Abstract. Semiconductor memories are at the base of the tremendous changes the Automotive is undergoing since now and until a very next future, when it will be fully connected, autonomous, shared and electric (CASE). This tutorial will show the semiconductor memory technology and development process required and adopted by the top car makers. The challenges that will be faced to enable their adoption in the automotive. How the autonomous driving - and the safety critical context it brings with it - is shaping the new, harder, requirements. Focus shall be put on the embedded memory system and its components details.

Short biography. Massimo laculo obtained a bachelor's degree in electronic engineering at Federico Il University (Naples - Italy) with a thesis in engineering and technology of control systems. He has worked in the IT field and then in software for industrial automation since 1990. Since 2001 he has been working, for ST Microelectronics before, Numonyx and Micron now, as Director of Firmware Development for NAND based storage media devices for which he is co-inventor of different patents.

Mauro Giacomini
(ST)

"77GHz Radar On Chip: enabling autonomous driving"

Abstract. Automotive Radar System is undergoing a transformation following the overall car architecture evolution and driven by a market that is expected to grow significantly in the coming years. After a quick overview of the FMCW radar fundamentals, we will address a simple system budgeting that will introduce us to the RF challenges for what concern Silicon design and package development.

Short biography. Mauro Giacomini was born in 1970 in Mantova, Italy. He received the M.Sc. degree in Electronic Engineering (Microelectronics, Optoelectronics and Instrumentation) from Politecnico of Milan in 1995 (cum Laude). After an experience in the field of optical communication within CoreCom (consortium between Politecnico of Milan and Pirelli S.p.A.) he joined STMicroelectronics as NonVolatile Memory designer in 1998. After three years he moved to Analog Design dealing with Data Converters, Voltage Regulators, Oscillators, PLLs and custom Analog Front-End, key IPs for the success of ST Automotive mController families from 90nm to 28nm technology nodes. He progressively acquired more responsibility unifying in 2018 in one unique organization all the analog developments and silicon validation functions (Analog, NVM & RF) to serve the Digital Automotive Product R&D.

Gaudenzio Meneghesso
(Università di Padova)

"Reliability of wide bandgap semiconductors for automotive electronics"

Abstract. The need for sustainable energy sources has continuously increased over the years. Given the costs and issue related to energy storage and transfer, the only real "clean" energy is the saved energy, leading to a strong push for improvement in energy efficiency. To this aim, a strong contribution can be provided by wide bandgap semiconductors. Thanks to their superior electronic properties, devices based on gallium nitride or silicon carbide can operate at higher frequencies compared to their silicon counterparts, leading to smaller passive elements, lower parasitics, and higher efficiency when used in a switching circuit. Moreover, their better robustness allows them to be safely used in high power applications, where low losses and efficiency are of the utmost importance. Even though wide bandgap-based devices can already be found in the market, a few open issues still limit their penetration. In this lecture I will review the main instabilities and degradation modes and mechanisms which still affect the wide-bandgap semiconductors devices (GaN and SiC).

Short biography. Gaudenzio Meneghesso (IEEE S'95–M'97–SM'07- F'13) graduated in Electronics Engineering at the University of Padova in 1992 working on the failure mechanism induced by hot-electrons in MESFETs and HEMTs. In 1997 he received the Ph.D. degree in Electrical and Telecommunication Engineering from the University of Padova. Since 2011 is with University of Padova as Full Professor. His research interests involve mainly the Electrical characterization, modeling and reliability of several semiconductors devices. Within these activities he published more than 800 technical papers (of which more than 100 Invited Papers and 10 best paper awards). He has been nominated to IEEE Fellow class 2013, with the following citation: "for contributions to the reliability physics of compound semiconductors devices".

Salvatore Cannavacciuolo
(ST)

Vittorio D'Angelo
(ST)

"Running towards car electrification"

Abstract. To stay on a path for the next ten years with the European Green Deal as a blueprint for change, the European Union finalized its master plan against greenhouse gas emissions: the 'Fit for 55' package, which brings on the table 2035 target to stop production of all ICE cars. This led to the challenge, for most of TIER1s and Silicon suppliers, to design more and more cost-efficient solutions for Automotive. How to face the challenge of optimizing battery efficiency, preserving safety of the drivers, and keeping car performance appealing is the deal of the moment for Automotive Eng.

Short biography. Salvatore Cannavacciuolo was born in Italy in 1981. He received the Electronic Engineering MS degree from the University of Napoli Federico II in 2006. He joined STMicroelectronics, Milano, Italy, in 2006. Since 2006, he has been working in company Automotive department, leading with major worldwide TIER1s. His current main areas of interest are Battery Management systems and Galvanic Isolated applications with focus on HW integrated solutions. After many years of leading of Automotive Electrification Application team, Mr. Cannavacciuolo now leads a mixed signal design team responsible of Smart power IC for Power Electronics applications.

Short biography. Vittorio D'Angelo was born in Italy in 1990. He received the Electronic Engineering MS degree from the University of Napoli Federico II in 2015. He joined STMicroelectronics, Prague, Czech, in 2014. During 2016, he joined STMicroelectronics Automotive department, as Application Eng supporting TIER1 application developments. Since 2018 Vittorio started dealing with Battery Management systems and Galvanic Isolated applications, as system architect.

Andrea Vecchiato
(Infineon)

"Main trends in automotive electronics: greener, safer and connected and how power electronics became one of the protagonists of this revolution"

Abstract. The presentation will give an overview of the factors that are driving this revolution and how they impact the developments of electronics in the car. Emphasis will be addressed to power management IC showing how Infineon interprets these new challenges.

Short biography. Andrea Vecchiato graduated in Physics from the University of Padova. In Semiconductor Company since 1995, designer of several IC for biomedical, aerospace and telecom (xDSL) applications for Alcatel microelectronics and ST Microelectronics. In 2005 he joined Infineon Technologies, as a concept engineer and design leader designing System Power Supply and standalone DCDC converter IC. Since 2012 R&D teams manager in Infineon Padua design Center, focusing on the development of Power Supplies ICs for Functional Safety automotive applications.

Tibor Grasser
(Technische Universität Wien)

"Reliability of Si and SiC Devices"

Abstract. Charge trapping is at the heart of many reliability issues in both Si and SiC devices and causes for example hysteresis, noise, and the bias temperature instability. After summarizing some key experiments which reveal the physical origin of these phenomena, accurate models will be discussed. In essence, charge trapping is shown to be a temperature activated phenomenon which can be described by a non-radiative multiphonon model. In addition, the experiments reveal the existence of meta-stable defect states which are responsible for various intricacies of the phenomenon. While the detailed model is very accurate, it will be shown that simplified models can be used to capture the essence. Most notably, the capture-emission time (CET), or better, activation energy (AE) maps will be introduced which provide a highly intuitive explanation for dynamic degradation under both DC and AC conditions. Finally, a simplified model for fast gate-stack optimization will be demonstrated to give excellent results across a wide range of degradation conditions and technologies.

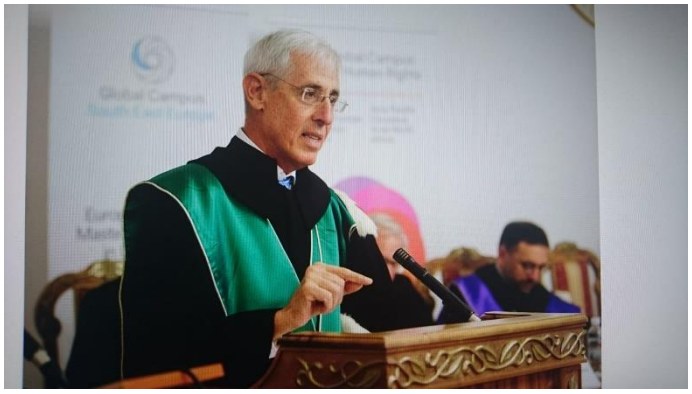
Short biography. Prof. Tibor Grasser is an IEEE Fellow and head of the Institute for Microelectronics at TU Wien. He has edited various books, e.g. on the bias temperature instability, hot carrier degradation, and noise (all with Springer), is a distinguished lecturer of the IEEE EDS, has been involved in outstanding conferences such as IEDM (General Chair 2021), IRPS, SISPAD, ESSDERC, and IIRW, is a recipient of the Best and Outstanding Paper Awards at IRPS (2008, 2010, 2012, and 2014), IPFA (2013 and 2014), ESREF (2008) and the IEEE EDS Paul Rappaport Award (2011).

Gregorio Cappuccino
(Università della Calabria)

"The battery: problem or opportunity?"

Abstract. On account of the increasing consumption of rechargeable batteries and of a rise in the adoption of electric vehicles, the global battery market size will be expanding at a very high rate in the next years. Due to the rising sales of electric vehicles and portable electronics, the expanding renewable energy sector is the factor that will drive the market. The emergence of raw materials, batteries, control and management circuits, as well as of technologies for battery reuse and recycling is creating serious issues to all the value chain players, forcing national and public agencies to support funding programs to cope with this. Anyway, "in the midst of every crisis, lies great opportunity." This short keynote just focuses on both the explicit and hidden opportunities, explicit that a scientist, skilled in the field of electronics, may seize on the entire battery value-chain.

Short biography. Gregorio Cappuccino is associate professor of Electronics in the Department of Electronics, Computer Science and Systems at the University of Calabria, Italy.
Dr. Cappuccino is also CEO of CalBatt, a spin-off company of the University of Calabria working in the field of high efficiency energy storage and EVs charging. CalBatt has been participated by Enel, the Italy's largest power company and Europe's second listed utility by installed capacity. Under his guidance in 2014 CalBatt was ranked in the top 10 most interesting innovative European Tech- Ventures at the Munich Cleantech Award and won the "Best Presentation Award" at the Cleantech Summit in Rotterdam.
Gregorio Cappuccino works on electronic systems for high-efficiency charging of battery for electric vehicles and grid storage. With more than 30 years of experience in R&D activity, he has been in charge of coordinating the energy storage-related activities for several international research projects dealing with the development of high-performance electronics systems for energy-efficient applications with leading European firms. He has been member of the Advisory Board of IEEE Transportation Electrification Initiative.
He has received the 2011 IEEE Real World Engineering Project Award for the Project "Coping with the Emerging Energy Demand for Charging Plug-in Electric Vehicles". He collaborated with Interprose PR for positions IEEE well within the industry, providing contributions to The Fierce Smart Grid, The Energy Collective, and Intelligent Utility. Moreover, he serves as reviewer/evaluator for several national and trans-national agencies for Collaborative Research/Industry Development Grant–Projects.



Enrico Sangiorgi
(Università di Bologna)

"A Chips Act for Europe: vision and remarks"

Abstract. This talk will review the global landscape and the position of Europe in the Semiconductor Ecosystem. Then the set of measurements proposed by the European Commission for strengthening the EU's semiconductor system, the so-called Chips Act, will be described. I will describe the structure of the Chips Act, which is made of three pillars: The Chips for Europe Initiative, Security of Supply, and Monitoring and Crisis response, its governance and the proposed budget allocation. A brief description of opportunities and threats will conclude the talk.

Short biography. Enrico Sangiorgi received the Laurea degree from the University of Bologna in 1979. He has been a Visiting Scientist at Stanford University and Bell Laboratories. Enrico Sangiorgi is Editor-in-Chief of the Journal of the Electron Device Society. He has been Editor of Electron Device Letters for 15 years. From 2015 to 2021 he has been Vice Rector for Teaching and Education at the University of Bologna. He is a member of the Aeneas Supervisory Board and Chairman of the Aeneas Scientific Council. He has been Director of the Sinano Institute (2014-20, now Director Emeritus). His research covers the physics, characterization, modeling, and fabrication of solid-state devices and integrated circuits. He has been working on device scaling, its technological, physical, functional limits, and reliability. Enrico Sangiorgi is Distinguished Lecturer of the Electron Device Society, Fellow of the IEEE (2005), and he has been member of the following IEEE Committees: Fellow, Cledo Brunetti Award, Educational Award. Enrico Sangiorgi coauthored more than 260 papers that received more than 4,000 citations and gained an h-index of 32.

Elena Gnani
(Università di Bologna)

"Trends and challenges in nanoelectronics for the next decade"

Abstract. In the last decade nanoelectronics devices have been a driving force for societal applications and for a green sustainable world. Key fields such as security, energy, healthcare, transport, communication and infotainment are gaining more and more market so that microelectronics is becoming an inherent part of everyday life. The research related to nanoelectronics can be grouped in three main directions, i.e., More Moore, Beyond CMOS and More than Moore. General trends and challenges will be addressed.

Short biography. Elena Gnani is Associate Professor at the University of Bologna. Her research interests include the development of physical transport models in semiconductor devices and numerical-analysis techniques, with special emphasis on the study of quantum-confined devices, such as FinFETs, silicon nanowires (NW), steep-slope devices as well as quasi ballistic transport in nanoMOSFETs. E. Gnani is author or co-author of more than 180 papers published in referred international journals and in proceedings of major international conferences. She is presently an IEEE Senior Member, EDS Distinguished, member of the EDS Technology Computer Aided Design Committee and serves as an associate editor of the IEEE Transactions on Electron Devices.