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GUEST EDITORIAL

EuMA special issue on RF-MEMS

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The wireless communication industry still faces the great challenge to handle multi-band mobile devices with very small form factors and low-cost components. In addition, antenna tuning elements are becoming a necessity to improve the battery lifetime. In this context, strong developments are going on to monolithically integrate high-Q Radio Frequency MicroElectroMechanical System (RF-MEMS) tuning elements on semiconductor production lines (e.g. complementary metal-oxide-semiconductor (CMOS)). The goal is to implement highly integrated and cost-effective solutions, combining the enhanced capabilities of MEMS technology, such as tunability and reconfigurability, with the considerable circuit design flexibility of integrated circuit (IC) technology for driving circuitry and the other RF and base band modules. At the same time, measurement equipment, aeronautic and space applications are demanding high-performance switching and tuning devices for the realization of next generation automated test equipment, multi-role radar and multi-band communication systems. Technically speaking, it has been shown that RF-MEMS offer superior performance and novel functionalities in terms of high-Q tunable filters, high-linearity switches, as well as low-loss phase shifters. Also, for this kind of applications, the trend for the monolithic integration with high-end semiconductors (SiGe, GaAs, GaN) is clearly observed, along with alternative stand-alone RF-MEMS solutions developed upon very advance and specific MEMS technology.

Driven by the pressing demand to meet industrial reliability standards, there is still a fairly high level of investigations on the in-depth understanding of the failure mechanisms hampering RF-MEMS commercial exploitation. Especially, the degradation over time and working conditions of critical parameters such as the contact capacitance or contact resistance in capacitive and resistive switches, respectively, remain central to current studies. An example is the dielectric charging yielding capacitance degradation for which lifetime prediction methodologies and recovery mechanisms are at stake.

This special issue summarizes current research results on RF-MEMS and their applications. The contributions published in this issue span the entire range from RF-MEMS devices, RF-MEMS-based circuitry to their implementation in antennas, and their system applications. In addition, the outcomes of the latest research on RF-MEMS reliability are included.

We are convinced that RF-MEMS-based circuitry will significantly contribute to the development of next generation microwave and millimeter–wave systems and hope that this issue stimulates the engineers and designers for further research and development in this area.

Fabio Coccetti received the M.S. degree in electrical engineering from the University of Perugia, Perugia, Italy and the Ph.D. title in High Frequency Engineering at the Lehrstuhl für Hochfrequenztechnik at the TUM in Munich Germany, in 1999 and 2004, respectively. In 2000 he has been a visiting scientist at the Radiation Lab at University of Michigan, USA. Since September 2004 he is working at the Laboratoire d'Analyse et d'Architectures des Systèmes (LAAS-CNRS) as research scientist in the micro and nanosystems for wireless communications group. In addition to this since 2008 he has joined the company Novamems as RF-MEMS specialist and R&D project manager. His research interests include numerical techniques optimization, multiphysics, design and modeling of reconfigurable circuits for microwave and millimeter-wave applications with focus on RF micro- and nano-mechanical devices and systems. He is member of the IEEE society, vice-chair of the MTT-S TC-25 on RF-Nanotechnology, and cofounder of the Topical Group on RF-MEMS within the European Microwave Association (EUMA).

Alexandru Müller received his Ph.D. in semiconductor physics from the University of Bucharest, Romania in 1990. He is the head of the RF-MEMS laboratory of the R&D Institute for Microtechnologies, IMT-Bucharest. His recent research work is focused on silicon and compound semiconductor microwave and millimeter-wave devices and circuits based on micromachining technologies, as well as on acoustic and photonic devices based on WBG semiconductors. He has coordinated or was responsible of the IMT team in FP4–FP7 EC funded projects. One of the first EC founded projects in the RF-MEMS topic, "MEMSWAVE" was coordinated by him and was nominated between the 10 finalists for the DESCARTES prize in 2002. Dr. A. Muller authored or coauthored more than 100 papers in journals and conference proceedings.

John Papapolymerou received the B.S.E.E. degree from the National Technical University of Athens, Athens, Greece, in 1993, the M.S.E.E. and Ph.D. degrees from the University of Michigan, Ann Arbor, in 1994 and 1999, respectively. From 1999 to 2001 he was an Assistant Professor at the Department of Electrical and Computer Engineering of the University of Arizona, Tucson and during the summers of 2000 and 2003 he was a visiting professor at The University of Limoges, France. From 2001 to 2005 and 2005 to 2009 he was an Assistant Professor and Associate Professor, respectively, at the School of Electrical and Computer Engineering of the Georgia Institute of Technology, where he is currently a Professor. He has authored or coauthored over 290 publications in peer-reviewed journals and conferences. His research interests include the implementation of micromachining techniques and MEMS devices in microwave, millimeter-wave, and THz circuits and the development of both passive and active planar circuits on semiconductor (Si/SiGe, GaAs) and organic substrates (liquid crystal polymer-LCP, LTCC) for System-on-a-Chip (SOC)/System-on-a-Package (SOP) RF front ends. Dr. Papapolymerou is the Chair for Commission D of the US National Committee of URSI. He was Associate Editor for *IEEE Microwave and Wireless Component Letters (2004–2007)* and *IEEE Transactions on Antennas and Propagation (2004–2010)*. He currently serves as Associate Editor for *IEEE Transactions on Microwave Theory and Techniques*. During 2004, he was the Chair of the IEEE MTT/AP Atlanta Chapter. He was the recipient of the 2010 IEEE Antennas and Propagation Society (AP-S) John Kraus Antenna Award, the 2009 IEEE Microwave Theory and Techniques-Society (MTT-S) Outstanding Young Engineer Award, the 2009 School of ECE Outstanding Junior Faculty Award, the 2004 Army Research Office (ARO) Young Investigator Award, the 2002 National Science Foundation (NSF) CAREER award, the best paper award at the 3rd IEEE International Conference on Microwave and Millimeter-Wave Technology (ICMMT2002), Beijing, China and the 1997 Outstanding Graduate Student Instructional Assistant Award presented by the American Society for Engineering Education (ASEE), The University of Michigan Chapter. He is a Fellow of IEEE.

Volker Ziegler received his Dipl.-Ing. degree in electrical engineering and his Dr. Ing. degree (with honors) both from the University of Ulm, Germany, in 1997 and 2001, respectively. From 2002 until 2003, he was member of the "Knowledge Exchange Group for Research and Technology" at the Daimler-Chrysler AG in Stuttgart, Germany. During this trainee program, he worked subsequently at the University of Michigan, Ann Arbor, USA, and at United Monolithic Semiconductors in Orsay, France. Since January 2003, he is working with EADS Innovation Works, in Ottobrunn, Germany. He is an EADS Expert for "Microwave Technologies and Systems" and is responsible for the acquisition and managing of national and international research projects in the field of key microwave technologies for advanced radar and communication systems.

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