DISTINGUISHED MICROWAVE LECTURERS

Applications of Phase Change Material (PCM) Technology in Tunable Filters and in Other Reconfigurable Microwave and Millimeter-Wave Devices

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Venue: Rm. 222, Ho Sin Hang Eng. Building, The Chinese University of Hong Kong

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Abstract Microwave and Millimeter-wave switches are key components in communication systems. They are used for signal routing and for realizing a wide range of reconfigurable microwave and millimeter-wave devices. Phase Change Materials (PCM) have been widely used in optical storage media and non-volatile memory device applications. Over the past recent years, there have been interest in exploiting the PCM materials such as germanium telluride (GeTe) and metal insulator transition materials such as vanadium oxides (VO2) for RF applications. The principle of operation of PCM devices is based on the ability of the material to transform from a high-resistivity state (amorphous phase) to a low-resistivity state (crystalline phase) and vice versa with the application of short duration pulses. Several orders of magnitude in resistivity change can be achieved by PCM technology allowing the realization of highly miniature microwave and millimeter-wave switches. In addition to miniaturization, GeTe based switches offer latching functionality and ease of monolithic integration with other RF circuits. This talk will address recent developments in PCM switches and their applications to the realization of reconfigurable filters, switch matrices, phase shifters, variable attenuators, and reflective intelligent surfaces. It outlines major design considerations for tunable filters presenting techniques to realize tunable filters that maintain filter performance over tuning range, illustrating examples of tunable filters tuned only a by single tuning element. The talk also addresses existing tuning technologies, providing a comparison between Semiconductor, MEMS and PCM tuning elements in terms of linearity, insertion loss, suitability for use at millimeter-wave frequencies and ease of integration with high-Q filters. Very recent results for PCM-based reconfigurable acoustic filters are also presented.

Biography Raafat Mansour is a Professor of Electrical and Computer Engineering at the University of Waterloo and holds Tier 1 - Canada Research Chair (CRC) in Micro-Nano Integrated RF Systems. He held an NSERC Industrial Research Chair (IRC) for two terms (2001-2005) and (2006-2010). Prior to joining the University of Waterloo in January 2000, Dr. Mansour was with COM DEV Cambridge, Ontario, over the period 1986-1999, where he held various technical and management positions in COM DEV's Corporate R&D Department. Professor Mansour holds 44 US and Canadian patents and more than 450 refereed IEEE publications to his credit. He is a co-author of a 23-chapter Book published by Wiley and has contributed 7 chapters to five other books. Professor Mansour founded the Centre for Integrated RF Engineering (CIRFE) at the University of Waterloo https://uwaterloo.ca/centre-integrated-rf-engineering/. It houses a clean room and a state-of-the-art RF test and characterization laboratory. He was as the Technical Program Chair of the 2012 IEEE International Microwave Symposium (IMS). Professor Mansour is a Fellow of the IEEE, a Fellow of the Canadian Academy of Engineering (CAE), a Fellow of the Engineering Institute of Canada (EIC). He was the recipient of the 2014 Professional Engineers Ontario (PEO) Engineering Medal for Research and Development and the 2019 IEEE Canada A.G.L. McNaughton Gold Medal Award.

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