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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

S E M I N A R

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Automatic Tuning of Millimeter-wave Silicon Photonics Receivers

by

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Abstract: Today, continuously growing wireless traffic shapes the progress in the wireless communication systems. Therefore, next generation of wireless communication systems are actively investigated to accommodate expanding data traffic of the future. As one of the most promising candidates, integrated photonic devices and circuits are able to improve the performance of the existing wireless system.

In this presentation, potential hybrid integrated mm-wave silicon photonic receivers for future wireless communication systems are explored. The proposed mm-wave silicon photonic receiver employs a tunable silicon photonic filter. Integrated photonic devices are vulnerable to the process and temperature variations. As a result, they require manual calibration, which is expensive, time consuming, and prone to human errors. Therefore, precise automatic calibration solution with modified monitor-based silicon photonic filter/beamforming structures is proposed and demonstrated. Also, thermal crosstalk effect in the photonic devices is investigated, and substrate thinning is proposed to suppress this effect and reduce calibration time to less than half. The proposed monitor-based tuning method compensates fabrication variations and thermal crosstalk by controlling micro-heaters as tuning elements individually using electrical monitors.

The proposed tuning approach successfully demonstrates calibration of silicon photonic filters in the mm-wave receivers from severely degraded initial responses to well-defined magnitude response. The proposed fully automatic tuning approach opens the possibility of employing silicon photonic filters in real communication systems.

Kamran Entesari received his Ph.D. degree from the University of Michigan, Ann Arbor, MI, USA, in 2005. In 2006, he joined the Department of Electrical and Computer Engineering, Texas A&M University, College Station, TX, USA, where he is currently a Professor. His current research interests include Integrated RF photonics, RF/microwave/millimeter-wave integrated circuits and systems, microwave sensing, and reconfigurable RF/microwave antennas and filters.

Prof. Entesari was a recipient of 2018 and 2017 Qualcomm Faculty Award and 2011 National Science Foundation CAREER Award. He was a co-recipient of the 2009 Semiconductor Research Corporation Design Contest Second Project Award, the Best Student Paper Award of the IEEE RFIC Symposium in 2014 (second place), the IEEE International Microwave Symposium in 2011 (third place), and the IEEE AP-S in 2013 (Honorable Mention). He is an associate editor of the IEEE Microwave and Wireless Components Letters, a member of editorial board for IEEE Solid-State Electronics Letters and a technical program committee member of the IEEE IMS and RFIC Symposiums.