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**“Microfluidically Loaded Highly Reconfigurable Compact Antennas and RF Devices”**

IEEE MTT/AP Orlando Chapter & Raj Mittra Distinguished Lecture Program

**DATE/TIME: Wednesday, November 30<sup>th</sup>, 2016 (3:00 PM-4:00 PM)**

**SPEAKER: Gokhan Mumcu**

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**ABSTRACT:**

Reconfigurable radio frequency (RF) antennas and filters have drawn growing interest to enable compact and light-weight multifunctional systems for wireless communications, sensor networks, biomedical imaging, and remote sensing. Existing reconfigurable RF device design approaches that are based on material loadings, semiconductor and ferroelectric varactors, micromechanical systems (MEMS) switches and capacitors are today well-recognized to offer compact and cost-effective device implementations with high reconfiguration speeds. However, these technologies continue to exhibit limited performance in terms of key RF metrics such as power handling, frequency tunability bandwidth, pattern scanning range, efficiency, and frequency-agile capability..

This presentation will focus on novel reconfigurable RF antennas, filters, and imaging systems realized by resorting to innovative microfluidic based reconfiguration techniques. The operational principles of these devices rely on continuously movable microfluidic loads consisting of metal (in liquid or solid form) and dielectric solution volumes. It will be shown that the proposed microfluidic reconfiguration techniques offer significantly improved frequency tuning range ( $>4:1$  and  $>2:1$  in monopole antenna and filter topologies, respectively) without suffering from excessive loss factors and high power handling issues observed in conventional semiconductor based implementations. Another example design will demonstrate that the microfluidic reconfiguration techniques lead to low-cost mm-wave (30GHz) beam-scanning high-gain antenna arrays without necessitating the use of costly and lossy phase shifters. Finally, it will be demonstrated that the microfluidically controlled metalized loads over the microstrip lines can be utilized to synthesize a low-cost RF read-out circuitry for interrogating a large format near-field imaging array consisting of sub-wavelength resonators.

**ABOUT THE AUTHOR**



Dr. Gokhan Mumcu is currently an Associate Professor in the Department of Electrical Engineering, University of South Florida. He obtained his B.S. degree in Electrical Engineering from Bilkent University (2003), and his M.S. and Ph.D. degrees in Electrical and Computer Engineering from The Ohio State University in 2005 and 2008, respectively.

His research interests are small antennas, engineered materials, and THz technologies. His most recent research work is focused on reconfigurable RF devices, antennas and arrays using microfluidic reconfiguration

techniques. Dr. Mumcu was a recipient of National Science Foundation CAREER award in 2014. He received faculty outstanding research achievement award from the University of South Florida in 2014. He ranked first on the national university entrance exam taken annually by over 1.5 million Turkish students in 1999. He was the recipient of a best paper award at 2008 URSI National Radio Science Meeting, and the 2008 outstanding dissertation award at the Ohio State University, ElectroScience Laboratory.

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