Department of Electrical and Computer Engineering

TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering™

Fall 2019 Seminar Series

Seminar Title: *Beamforming in Massive MIMO for Millimeter-Wave New Radio*
Time: 3:00-4:00 PM, Friday, Oct 18, 2019
Location: ECE 101

Speaker:
Abbas Omar
University of Magdeburg, Germany

Abstract:
There are two perspectives in dealing with beamforming in massive MIMO. The IEEE-ComSoc community has been used to perform the entire MIMO Signal Processing, including the beamforming one, in the Digital Domain. This would require appreciable computational capacity at both base stations and mobile units if it were transferred to Massive MIMO in the Millimeter-Wave New Radio, where hundreds of antennas are involved. Following such a "Fully Digital Solution" perspective would also necessitate that each of the array elements must have its own RF Frontend. The IEEE-MTTS community, on the other hand, must be in some doubt about the feasibility of providing such a huge amount of RF Frontends, with PA/LNA, Up/Down Converting Mixers, DA/AD Converters, Filters, etc. backing each individual array element of a Massive-MIMO antenna array. One of the crucial issues in this scenario is the heat generation by the PA's and the proximity of the LNA's, whose noise performance strongly depends on the ambient temperature. Splitting down the large array into separate medium-size arrays is one of the scenarios recently implemented. However, the directivity of such separate arrays is much lower than that of the large one. Therefore, they are not capable of generating beams with the same narrowness of those generated by the composite one. Multiple beam operations considerably benefit from narrow beams. The alternative, which is called "Hybrid Solution", is to use Subarrays, with a single RF Frontend per Subarray. Steerable Multiple Beams would need in this case Butler Matrices and/or Rotman Lenses with multiple Couplers and Phase Shifters for each Subarray. A comparison between these two alternatives as regarding Hardware/Software complexity, power consumption in both the RF Frontend and the Digital Signal Processing, Linearity and Efficiency of PA's, Signal Distortion, etc. is the main subject of this talk.

Speaker Bio:

Abbas Omar received the B.Sc., M.Sc. and Doktor-Ing. degrees in electrical engineering in 1978, 1982 and 1986, respectively. He has been professor of electrical engineering since 1990 and director of the Chair of Microwave and Communication Engineering at the University of Magdeburg, Germany since 1998. He joined the Petroleum Institute in Abu Dhabi as a Distinguished Professor in 2012 and 2013 as an organizer of the research activities for the Oil and Gas Industry in this area. In 2014 and 2015 he chaired the Electrical and Computer Engineering at the University of Akron, Ohio, USA. Dr. Omar authored and co-authored more than 470 technical papers extending over a wide spectrum of research areas. His current research fields cover the areas of microwave, magnetic-resonance, and acoustic imaging, microwave and millimeter-wave material characterization, phased arrays and beamforming, massive MIMO, indoor positioning, subsurface tomography and ground penetrating radar, and field theoretical modeling of microwave systems and components. He is IEEE Fellow.