Monday, April 15, 9:30-10:30 AM
Computer Science 425

Faculty candidate: Professor Jade Morton
Title: Global Navigation Satellite Systems and Ionospheric Remote Sensing

Abstract: The ionosphere is an unavoidable pathway through which all space-based radio communication, navigation, and surveillance signals must travel. Understanding ionospheric effects on radio signals propagation and using radio waves to study ionosphere phenomena have been active research areas for many decades. In recent years, global navigation satellite systems (GNSS) signals have gained recognition as a powerful and versatile means for ionospheric remote sensing because of their well-defined signal structure, global coverage, and distributed and passive nature. For satellite navigation engineers, the ionosphere is a complex and dynamic medium characterized by erratic behavior and spatial irregularities, which interfere with GNSS signal propagation, potentially disrupting applications such as aviation, intelligent transportation, guided weapons systems, precision agriculture, surveying, tracking and communications that have grown to rely on GNSS services.

In this presentation, I will first discuss a globally-distributed autonomous data collection network of GNSS receiver arrays at strategically selected locations to facilitate a data-driven approach to study the complexity of ionospheric phenomena and their impact on GNSS. During the past two years, this multi-constellation multi-band network of receivers has generated over 50 TB of data that includes artificially-controlled and naturally-occurring space weather event signatures. I will present two drastically different approaches to processing these data. The first approach is driven by the goal to accurately preserve the received satellite signal parameters in their distorted states for scientific studies of the physical processes that lead to the signal disturbance. The second approach aims to develop robust GNSS receivers that can overcome signal distortion or abnormal behavior to ensure accurate and continuous navigation solutions during ionosphere disturbances. Space weather event characteristics, such as their temporal, spatial, spectral, and seasonal distributions, as well space plasma dynamics derived from the data will also be presented. Finally, I will highlight several other on-going research and teaching initiatives and outline my future research plan.

Bio: Dr. Jade Morton is a professor in the Department of Electrical and Computer Engineering at Miami University. She holds a PhD in EE from Penn State and was a post-doctoral research fellow at the University of Michigan Space Physics Research Laboratory. Her current research interests are in advanced global navigation satellite systems (GNSS) receiver algorithms, ionospheric effects on GNSS performance, ionospheric remote sensing using GNSS and other RF techniques, software-defined UWB radar for navigation, and navigation-sensor integration and applications. She has served in various capacities at the Institute of Navigation (ION) and IEEE and chaired numerous sessions, tracks, workshops, and conferences for ION and IEEE. She is a member of the editorial board of the journal GPS Solutions, an associate editor for IEEE Transactions on Aerospace and Electronic Systems, and a technical committee member of the IEEE Microwave Theory and Technology Society, Digital Signal Processing Subgroup. She is currently the chair of the ION Satellite Division.