



Ph.D. DISSERTATION DEFENSE

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Degree: Doctor of Philosophy
School/Department: Charles V. Schaefer, Jr. School of Engineering and Science/
Electrical and Computer Engineering
Date: Tuesday, October 1st, 2024
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Title: Signal Processing for Distributed RF Sensing With Non-Orthogonal Waveforms

Chairperson: Dr. Hongbin Li, Department of Electrical and Computer Engineering

Committee Members: Dr. Yanghyo Kim, Department of Electrical and Computer Engineering
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ABSTRACT

Distributed multi-input multi-output (MIMO) RF sensing systems, which consist of multiple transmitters and receivers located at different positions, offer advantages such as higher spatial resolution, increased degrees of freedom, and enhanced target detection. However, practical deployment is challenged by asynchronous propagation paths, leading to synchronization errors, non-orthogonal waveforms, and the presence of both auto-correlation and cross-correlation terms at the matched filter (MF) output. This dissertation investigates these issues in realistic environments, focusing on asynchronous propagation, cross-correlation effects, and target detection under cluttered conditions. Specifically, the dissertation consists of three parts. The first part examines the impact of non-orthogonal waveforms and synchronization errors on target detection. The second part introduces a transmission delay compensation scheme to optimize the alignment of cross-correlation and auto-correlation terms at the MF output. The final part focuses on joint moving target detection and clutter suppression with non-orthogonal waveforms.