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Biography (中英文):

谢壮，国防科技大学博士研究生，国防科技大学优秀硕士学位论文、湖南省优秀硕士学位论文获得者，研究方向为优化理论及其在波形设计方面的应用。目前已发表学术论文 18 篇，其中以第一作者在 IEEE TSP、TAES 等领域内重要期刊上发表 SCI 论文 9 篇。担任 IEEE 信号与图像处理、信号处理系统等国际会议技术委员会委员（TPC Member），以及 IEEE TSP，TVT 等期刊审稿人。

Zhuang Xie received the B.S. degree in Electronic Information Engineering from the Harbin Institute of Technology, Harbin, China, in 2018, and the M.S. degree in Information and Communication Engineering from the National University of Defense Technology, Changsha, China, in 2020, where he is currently pursuing the Ph.D. degree. His research interests include radar signal processing and optimization theory, with emphasis on radar waveform design. He received the Best Presentation Award in The IEEE International Conference on Signal and Image Processing (ICSIP), the outstanding M.S. degree thesis of the National University of Defense Technology and the Hunan Province. He serves in Program Committee for various international conferences such as IEEE ICSIP, ICSPS, and also as an invited speaker of the first National Defense Technology Highland Forum (2023), Changsha, China.

Speech Title: (中英文):
智能反射面辅助雷达：性能分析和联合设计
RIS-aided radar for target detection: performance analysis and joint active-passive design

Speech Abstract: (中英文)
智能反射面（Reconfigurable intelligent surface，RIS）通过提供控制电磁波的新维度为雷达系统带来了变革潜力。本报告旨在进一步挖掘 RIS 在雷达应用中的潜力，通过联合利用 RIS 和雷达端自由度来增强目标检测性能。报告将首先阐述 RIS 辅助雷达的基本概念，从雷达视角推导 RIS 辅助雷达信号模型。通过对该模型进行分析，我们发现 RIS 的部署在辅助雷达探测的同时也会影响到杂波区域的分布。对于兼顾了多波形约束和 RIS 硬件限制的非凸联合设计问题，开发高效的优化算法成为该研究的一个重要任务。因此，报告将详细介绍基于 Alt-Opt-Majorization-Minimization（AOMM）框架的求解方法。最后，报告将结合仿真实验展示优化后的 RIS 辅助雷达在目标检测方面的优越性，并深入分析雷达，RIS 以及目标之间的相互作用，尤其是不同参数对系统性能的影响以及 RIS 在系统中所扮演的角色。

Reconfigurable Intelligent Surface (RIS) brings a transformative potential to radar systems by providing a new dimension to control electromagnetic waves. This lecture focuses on target detectability enhancement through the design and analysis of RIS-aided radar. A comprehensive signal model is established, recognizing both Line of Sight (LoS) and Non-Line of Sight (N-LoS) returns, factoring in RIS location and range gate shifts. This modeling enables an examination of the RIS-dependent effect of enlarged clutter region, underscoring the essential need for precise RIS phase optimization. A joint design problem encompassing transmit waveform, receive filter, and RIS phase is then formulated with the aim to optimize Signal-to-Interference-plus-Noise-Ratio (SINR), complying with practical waveform constraints and discrete RIS phase alphabet. For this

nonconvex problem, an iterative algorithm is developed to monotonically enhance SINR, ensuring convergence by alternately updating the radar waveform and RIS phases. Through the majorization-minimization framework, radar waveform updates are achieved using the feasible point pursuit technique, while a quasi-closed form solution is employed for the RIS phases. Simulation results demonstrate the efficacy of the proposed design, revealing the crucial role of RIS in the system.