

“Ambient Sensing through Reconfigurable Intelligent Surfaces”

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Current wireless sensing systems aim to accurately and efficiently detect, estimate and extract useful physical information/features of designated targets by exploiting radio wave transmission, reflection, diffraction and scattering. However, existing wireless sensing systems face critical challenges in practice (non-availability of line-of-sight link, limited sensing range due to high path loss, etc.). Furthermore, wireless sensing is expected to become a major service of the next generation (6G) wireless networks, in addition to wireless communication services. In such an Integrated Sensing and Communication (ISAC) framework, the emerging technology of Reconfigurable Intelligent Surfaces (RISs) has been recently proposed to reconfigure the radio propagation environment for not only boosting the wireless communication coverage and capacity, but also enhancing sensing in an ambient way.

This tutorial presentation will cover design issues of the aforementioned envisioned ambient sensing environment that range from the design of the RIS elements to various RIS-aided sensing architectures, to optimization and deployment issues. Furthermore, open issues and challenges associated to unlock the potential of RISs for the implementation of the ISAC framework are addressed. Finally, performance evaluation results from both analytical studies and experimentation are presented, for representative ambient sensing use cases with emphasis to human posture recognition and assistive health care.