

Topic: **Reconfigurable surfaces for wireless communications:
Transmission schemes with minimal CSI requirement**

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Short Abstract:

Reconfigurable Intelligent Surfaces (RIS) is envisioned to offer spectral efficiency gains by utilizing a large number of passive reflecting elements that induce phase shifts on the impinging electromagnetic waves to smartly reconfigure the signal propagation environment. This can be particularly relevant bearing in mind the shift towards using higher frequencies including the mmWave and THz bands. Many works in the literature have shown promising gains assuming the availability of perfect channel state information (CSI) at the base station (BS) to optimize its transmission and the RIS reflection. This assumption is highly impractical, and a shift towards less demanding schemes in terms of CSI is needed to improve the feasibility of RIS deployment. In light of this, we study transmission schemes for RIS-assisted systems which have minimal CSI requirement, and demonstrate that gains can be achieved even in this case. In particular, we consider transmission schemes that rely on channel statistics only and use random rotations and opportunistic beamforming to enhance performance while lowering the CSI acquisition requirement. In addition to this, many works in the literature focus on studying RIS-assisted systems in the narrowband. However, an RIS can have a wideband response, and such a response can be beneficial in some scenarios. We show that an RIS with a well-designed wideband response can be effective in scenarios where only user location is known by leveraging an optimization of the phase-frequency response of the RIS. We propose methods for the design of the RIS during its fabrication phase as well as methods for its optimization during the operation phase. As an outlook into future uses of reconfigurable surfaces, we discuss stacked intelligent metasurfaces and their potential use in future wireless networks.

Bio:

Anas Chaaban received his Maitrise-es-Sciences degree in Electronics from the Lebanese University, Lebanon, in 2006. He received his M.Sc. degree in Communications Technology and his Dr.-Ing. (Ph.D.) degree in Electrical Engineering and Information Technology from the University of Ulm and the Ruhr-University of Bochum, Germany, in 2009 and 2013, respectively. From 2008 to 2009, he was with the Daimler AG research group on machine vision (machine learning), Ulm, Germany. He was a Research Assistant with the Emmy-Noether Research Group on Wireless Networks at the University of Ulm



from 2009 to 2011, which relocated to the Ruhr-University of Bochum in 2011. He was a postdoctoral researcher at the Ruhr-University of Bochum from 2013 to 2014, and at King Abdullah University of Science and Technology, Saudi-Arabia, from 2015 to 2017. He joined the University of British Columbia, Okanagan Campus, as an Assistant Professor in 2018. His research interests are in the areas of information theory, coding, and their application in wireless communications.

Dr. Chaaban received the Canadian Society of Information Theory paper award in 2019, the best paper award at ICCSPA in 2015, and the best poster award at the IEEE Communication Theory Workshop in 2011. He received the Thank a Prof. Award from the UBCO Center of Teaching and Learning in 2020 and 2022. He is a member of the IEEE since 2009, a Senior Member since 2017, and a member of the Canadian Society of Information Theory since 2018. He served as an editor for the IEEE Transactions on Communications (2018-2023), IEEE Access Special Section on Optical Wireless Technologies for 5G Communications and Beyond (2017), Wiley Transactions on Emerging Telecommunications Technologies (2017-2018), and the EURASIP Journal on Wireless Communication Networks (2017-2018). He served on the organizing committees of several conferences including the IEEE Globecom, Communication Theory Workshop, IEEE PIMRC, the IEEE NASIT, among others, as well as a TPC member in several conferences. He currently serves as a member of the IEEE ITSoc School's committee.

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