PhD offer

At the Institute of Electronics and Telecommunications of Rennes (UMR CNRS 6164), France

COMPACT BEAMFORMING LENSES FOR METASURFACES WITH AZIMUTHAL AND ELEVATION SCANNING

Project context

Reconfigurable high-gain antennas have become an indispensable component for most satellite communication systems. This kind of antennas must possess beam-scanning capabilities while offering also low profile and low cost. These features can be achieved by combining a switching feeding network for azimuthal scanning with a variable radiating aperture. Concerning the feeding section, quasi-optical beam-formers have been extensively used for azimuthal beam-steering [1],[2], but most of them do not cover the entire angular range from 0° to 360°. Risley prisms are a good solution to overcome this limitation, but they are usually bulky due to the focal illumination of the double-prism system.

Challenge

Novel lenses must be developed to provide complete azimuthal coverage with a compact structure. Surface wave (SW) lenses have been studied [3] to provide new functionalities and conception methods. SW lenses exploit the spatial variability of the boundary conditions, implemented through modulated metasurfaces (MTS), to mold the SW wave-front. These can be described by Flat Optics formulation [3], which is an adaptation of Geometrical Optics to SWs.

[1] F. Doucet *et al.*, "Shaped continuous parallel plate delay lens with enhanced scanning performance," *IEEE Trans. Ant. Propag.*, vol. 67, no. 11, pp. 6695–6704, Nov 2019.

[2] M. Ettorre, R. Sauleau and L. Le Coq, "Multi-beam multi-layer leakywave SIW pillbox antenna for millimeter-wave applications," *IEEE Trans. Ant. Propag.*, vol. 59, no. 4, pp. 1093–1100, Apr. 2011.

[3] E. Martini, M. Mencagli, D. González-Ovejero and S. Maci, "Flat optics for surface waves," *IEEE Trans. Antennas Propag.*, vol. 64, no. 1, pp. 155–166, Jan. 2016.

Objectives of the PhD offer

The main objective will be to develop an extremely compact beamforming network based on a 2-layer structure. This structure will be able to vary azimuthally the plane wave direction across the total angular range. The beam-former will be placed at the bottom layer, whereas the top layer will host a rotating MTS aperture in charge of the radiation. In this way, two-dimensional scanning will be obtained with a compact structure, overhauling classical Risley architectures.

Candidate

Required education level: Master or equivalent degree in electrical engineering or physics.
Duration: 36 months.
Required background: antenna theory, microwave engineering, numerical modeling, periodic structures. Knowledge of French is not required, but will be appreciated.

Deadline to apply: as soon as possible.

Contact persons

To apply please send your motivation letter, CV, and recommendation letters (optional) to:

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