Reducing the Dispersion of Groove Gap Waveguide Leaky-wave Antennas by Loading with a Pin-type Prism

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Gap-waveguide technology and its applications have been popularly proposed in recent years. Their advantages include easy manufacture, competitively low loss for high frequencies and no physical contact between the two layers that create the waveguide. Leaky-wave antennas (LWA) can be easily realized by using gap-waveguide technology (M. Vukomanovic, J.-L. Vazquez-Roy, O. Quevedo-Teruel, E. Rajo-Iglesias, Z. Sipus, *IEEE Transactions on Antennas and Propagation*, 64, 2055-2060, 2016). However, these LWAs have a beam-squint effect, which is a typical property in most LWAs. This effect limits the application of LWAs for communication purposes, since high gain at a a single radiation direction over a wide frequency-band is required.

In this abstract, we combine a gap waveguide LWA with a metasurface-prism to mitigate the effects of beam-squint. The groove gap waveguide is designed with pins, in their high-impedance region, to confine the electromagnetic waves (P.-S. Kildal, A. Zaman, E. Rajo-Iglesias, E. Alfonso, and A. Valero-Nogueira, *IET Microwaves, Antennas and Propagation*, 5, 262-270, 2011). On the other side, pins with lower height and periodicity are used to allow a controlled radiation. Finally, a metasurface-prism with a third pin-type lattice and height is employed to compensate the dispersion of the radiated leaky waves. Following this idea an antenna operating in the X band has been designed. The antenna with the integrated prism offers a good performance with a 22% frequency bandwidth for the 3-dB realized gain. Both the antenna and the prism are realized in the same technology (based on the use of metallic pins on a parallel plate as periodic structure) and its integration as one single component is straightforward.

In the conference, we will present results in terms of dispersion diagram, which will demonstrate the operation of the proposed technique as well as the design methodology. Later on, full-wave simulations will be employed to design and demonstrate the performance of the antenna designed as example. Finally, experimental results will be presented to demonstrate the potential of the suggested technique.