Analysis and Design of Polarization Sensitive Planar Guides

Symon K. Podilchak*[(1)], Jafar Shaker[(2)], Reza Chaharmir[(2)], and Yahia M.M. Antar [(1)]
(1) The Royal Military College of Canada, Ontario, Canada, antar-y@rmc.ca
(2) The Communications Research Centre, Ontario, Canada, jafar.shaker@crc.ca

Most recently there has been an interest in new approaches that allow for the control and tailoring of electromagnetic surface waves (SWs) on grounded dielectric slabs (GDSs) at microwave and millimeter-wave frequencies. Both isotropic and more exotic anisotropic surfaces have been examined by the engineering of printed, sub-wavelength metallic patterning on a GDS. Applications include new lenses, transitions, and antennas.

Following these developments we propose a new type of planar guide for microwave frequencies which can offer advantageous polarization characteristics. Consider an arrangement of sub-wavelength metallic strips printed uniformity on a GDS. These elements can alter the effective dielectric constant of the slab, and when contained within a fixed width for transmission line applications, a planar SW guide can be achieved that allows for field confinement. Now by introducing a second arrangement of metallic strips but with an orthogonal orientation, and when driven by the appropriate field orientation, phase advancement within the guide can be responsive to the input polarization. In effect, the two modes are orthogonal which can demonstrate isolation. Concepts are similar to the more classic image guide which can support both TM and TE modes.

Comparable communication schemes have been developed for wireless systems and optical fiber telecommunications where polarization specific fields are modulated to increase channel capacity. Similarly, our proposed polarization sensitive waveguide has the potential to increase the density of low cost transmission lines while also improving signal integrity. These novel SW power routing techniques, which can exploit line polarization and offer enhanced data capacity, are also applicable to new planar antennas and other printed circuits.