Frozen Modes in 3-Way Coupled Microstrip Lines

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Periodic assembly of engineered structures can lead to unconventional modes diversity exhibiting bandgaps and frozen modes in their dispersion relations which they can be utilized in many applications in microwave and optical regimes. Harnessing the frozen modes in guided wave structures can lead to design true time delay signals, phase shifters, filters, and sensors. In this work, 3-way coupled periodic microstrip lines are designed to hold stationary inflection points (SIPs) in their dispersion relation where speed of electromagnetic waves vanishes. Anisotropic medium is implemented to divers the topology of the circuit model where three modes efficiently couple and degenerate at the SIP. Unlike the degenerate band edge (DBE) designed in (C. Locker, K. Sertel and J. L. Volakis, "Emulation of Propagation in Layered Anisotropic Media With Equivalent Coupled Microstrip Lines," in *IEEE Microwave and Wireless Components Letters*, vol. 16, no. 12, pp. 642-644, Dec. 2006), the SIP provides wider bandwidth where it occurs in the propagating band. Moreover, instead of implementing magnetized ferrite layers for realizing the frozen mode (G. Mumcu, K. Sertel, J. L. Volakis, I. Vitebskiy and A. Figotin, "RF propagation in finite thickness unidirectional magnetic photonic crystals," IEEE Transactions on Antennas and Propagation, vol. 53, no. 12, pp. 4026-4034, Dec. 2005), the 3-way coupled microstrip lines obtain the frozen modes using simpler geometry consisting of three microstrip lines over anisotropic substrate. Transfer matrix method is implemented to trace and identify the frozen mode in the structure to efficiently feed the device where the frozen mode is realized. Detailed results will be shown at the conference.