Abstracts

Evolution of leaky modes on printed-circuit lines

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The frequency evolution of dominant (quasi-TEM) and higher order modes on an open printed-circuit structure such as a microstrip is examined. Three different mode types are considered, including bound modes (BMs), leaky modes that leak into the surface wave of the background structure, and leaky modes that also leak into space. One of the fundamental goals is to establish the conditions under which one type of mode can transition into another type as the frequency changes. One important conclusion is that the dominant BM can never transition into a leaky mode for a microstrip structure with an isotropic substrate, but such a transition is possible for an anisotropic substrate, observed originally by Tsuji et al. and Shigesawa et al. However, higher order BMs can directly transition into leaky modes, as shown by Oliner and Michalski and Zheng. On other structures such as coplanar strips, where the bound dominant mode exhibits odd symmetry, a transition from a bound dominant mode to a leaky mode is possible, as shown by Shigesawa et al. and Tsjui et al. In addition to examining the mathematical transitions that are possible, the physical continuation of modes is also investigated, by examining the frequency evolution of the currents excited by a practical source. It is concluded that there may be physical continuity between modes, even if there is no mathematical continuity.

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