Abstracts

Analysis of mode coupling on guided-wave structures using Morse critical points

A.B. Yakovlev and G.W. Hanson. "Analysis of mode coupling on guided-wave structures using Morse critical points." 1998 Transactions on Microwave Theory and Techniques 46.7 (Jul. 1998 [T-MTT]): 966-974.

New insight on mode coupling in waveguiding structures is obtained from the theory of Morse critical points (MCP's). It is shown that the traditional coupled-mode formalism has a clear analytical connection with functional properties of the characteristic determinant in the vicinity of the Morse critical point, which determines the minimum of coupling. The relationship between perturbed and independent modes in the mode-coupling region is obtained using the Taylor polynomial of order two about the Morse critical point, and it is found that the coupling factor is proportionally related to the value of a characteristic function at this point. The qualitative modal behaviour in the mode-interaction region is predicted by a simple normal form, which can be geometrically interpreted as a result of the intersection of a saddle surface and a plane corresponding to the minimum of the coupling factor. Numerical results for a variety of guided-wave structures, including printed-circuit transmission lines, planar-slab waveguides, and shielded microstrip-like lines demonstrate the efficiency of the proposed approach for the rapid identification of mode-coupling regions, and for reconstruction of dispersion behaviour in those regions via simple analytic (normal) forms.

❑ Return to main document.