Abstracts

General Synthesis of Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers

R. Levy. "General Synthesis of Asymmetric Multi-Element Coupled-Transmission-Line Directional Couplers." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 226-237.

An exact synthesis procedure is derived for a class of asymmetric multielement coupled-transmission-line directional couplers with any number of elements. It is based on the equivalence between the theory of the directional coupler and that of a stepped quarter-wavelength filter. This can be treated using Richards' theorem for the synthesis of transmission-line distributed networks, as described previously by Riblet. The method is extended to give a general expression for the input reflection coefficient of the stepped filter, which corresponds to the voltage coupling of the directional coupler. Explicit formulas for the parameters of two, three, four and five couplers are derived and the extension to larger number of elements is straightforward. Two and three element couplers have been designed on this theoretical basis, and show excellent agreement with theory, for example a three element coupler of 20 db ±0.5 db over a 6:1 bandwidth, and a two element coupler of 3.2 db ±0.85 db over a 6.7:1 bandwidth. It is possible to design a 3-db ±0.43 db-coupler for decade bandwidths using only four elements. The 3 db-couplers may be used as 90° hybrids by careful choice of reference planes in the output parts.

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