Abstracts

A New Method of Synthesizing Matched Broad-Band TEM-Mode Three-Ports

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A new method of synthesizing matched broad-band TEM-mode three-ports is presented. The three-ports consist of n sections in cascade with each section composed of two coupled lossless transmission lines of electrical length theta and an intermediate resistor. The main object is to analyze and design broad-band unsymmetrical structures with the symmetrical three-port as a special and important case. The analysis of the three-port is performed by means of a more convenient four-port analysis. An even-odd-mode method is used and a new definition of the odd mode is introduced. This new definition considerably simplfies the treatment of unsymmetrical three-and four-ports with one half of the network identical to the other apart from an impedance scaling factor. The analysis yields two uncoupled two-ports in each mode. The even-mode networks are identical with cascaded quarter-wave impedance transformers while the odd-mode networks contain all the resistors. A new technique for their design is presented and a computer program for complete synthesis of hybrid three-ports has been worked out. Several experimental stripline three-ports were built. A three-section unsymmetrical (k=1.7) matched three-port showed a measured isolation better than 20 dB and a maximum VSWR of 1.3 from 5 to 12 GHz. The total loss of a four-section equal-power divider was 0.2dB, maximum VSWR 1.25, and minimum isolation 23 dB over the frequency range 2.5-12.0 GHz.

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