VIII-5. FULL-BAND MATCHING OF WAVEGUIDE DISCONTINUITIES

F. C. DeRonde (Invited)

Philips Research Laboratories, Eindhoven, Netherlands

Almost all waveguide components consist of transitions, either continuous or discontinuous, because they are either of modified structure or filled with some material. Such transitions vary from simple types, such as transitions from one waveguide to another (like a flange coupling, E- or H-plane shift, E- or H-plane bend, twist, window, or in-guide detector), to more complicated types, where a change in mode also occurs, as in transitions from rectangular to circular or square waveguide, coaxial or strip line, etc. Another example of this latter more complicated type is the Magic Tee.

Although it is a long time since waveguide components were first developed, they are still far from perfection, especially when they are rather complicated, and their length is in the order of the wavelength, or even short with respect to it. Such properties are of special interest nowadays in view of universal attempts at miniaturization, while broadbanding efforts are also of importance for wide band applications. A special continuous or stepwise transition has often been used. These, however, are rather long and usually only a fair compromise. The new full-band matching technique is based on the simple principle that a reflection due to a discontinuity can best be compensated by a reflection of the same frequency dependence over the waveguide band, but of opposite sign, and excited in the same reference plane. Therefore a transition in a component has to be made in steps, so-called "lumped" discontinuities. If the number of steps is kept as low as possible, extremely short broadband components can be made. The compensating technique is not restricted to lossless discontinuities, but may also be applied if losses are present.

At X-band the following components have already been realized with a reflection coefficient never exceeding 1%: choke flange couplings, E- and H-plane shifts, bends, twists, windows, sensitive in-guide detectors, and corners. The following such items are under development: transitions from rectangular waveguide to circular, square, and ridge waveguides, and to coaxial line, and a real magic tee.

The matching technique is a consequence of the possibilities of the Reflectoscope[1], a valuable instrument for better understanding of microwave phenomena.

1. F. C. de Ronde, "A Precise and Sensitive X-band Reflecto"meter" Providing Full-Band Display of Reflection Coefficient," IEEE Trans. MTT-13, pp 435-440, July 1965.