

SUMMARY / ABSTRACT

The thesis presents exhaustive investigations on slot coupled junctions. It starts with the evaluation of three port equivalent network of H plane slot coupled tee junction in terms of geometrical parameters of the junction. From three port equivalent network, the expressions for the impedance loading seen by the primary guide, return loss looking from the primary guide and also from the tee arm, coupling are evaluated. A comparison between theoretical and experimental results is presented.

In order to find the elements of the S matrix of the junction, moment method formulation with entire basis functions is applied. This formulation enables the determination of the symmetric and antisymmetric scattering coefficients and hence the series element of the equivalent network seen by the primary guide. Expressions for the elements of the S matrix are derived in terms of the geometrical parameters of the junction. Variation of magnitude and phase of the elements of the S matrix is presented. Unitary property of the S matrix is verified in the frequency range of interest.

Using moment method formulation, it is possible to determine the equivalent T network seen by the primary guide. The series arm is found to be negligible and hence for all practical purposes, the equivalent network can be considered to be shunt element. The normalised conductance and susceptance of the equivalent network are evaluated. The method of experimental verification is discussed.

The analysis is also carried out in presence of partial dielectric loading. For a dielectric filled tee arm the waveguide dimensions are reduced in order to maintain the cut off frequency. The effect of loading the slot as well as the tee arm are found. Elements of the S matrix for this dielectric filled junction are determined in terms of geometrical and electrical parameters of the junction. The condition satisfied by the S matrix of the junction with unequal port impedances is verified.

Investigations are carried out for a more important class of junction designated as coplanar E - H plane tee junction in which case, the coupling slot is inclined with respect to the axis of the guide. Analysis based on variational formulation for the determination of the three port equivalent network is used in this case. The moment method formulation is also used for this junction in order to find the electrical parameters of interest.

In the three port equivalent network, the contribution of internal energy storage involves evaluation of quadruple integral which contains spatial susceptance. In the moment method formulation, the corresponding innerproduct is of the same form. In order to avoid duplication of this mathematical evaluation, only the quadruple integral in the innerproduct is evaluated using appropriate coordinate transformation. When only first term in the double summation is retained and the contribution of the real part of the dominant mode term is deleted, the integral appearing in the expression for the

reactance in the three port equivalent network due to internal energy storage is obtained.

Coupling and return loss are evaluated and comparison between theoretical and experimental results is presented. Condition satisfied by the S matrix is verified.

K E Y W O R D S

Waveguide junctions, Tee junctions, Electromagnetic coupling, Variational formulation, Moment method of analysis, Three port equivalent network, S Matrix of junctions, Dielectric filled junctions, Coplanar E - H plane tee junction, dyadic Green's function.