SUMMARY

In the investigations reported in this thesis studies have been made of the excitation of waveguides and waveguide radiators. The cases of following excitation mechanisms have been studied.

(i) Coaxial line to waveguide transition driving a rectangular or circular waveguide and waveguide radiators through an L-shaped loop.

(ii) Coaxial line to waveguide transition exciting a circular cylindrical waveguide through a radial probe.

The electromagnetic interaction of a TEM standing wave current distribution in the conductor forming a coupling loop or a probe with the waveguide modes is studied. Expressions for the real and imaginary parts of the input impedance seen by the coaxial line are determined from the self reaction of the loop or probe current. The self reaction takes into account the interaction of the current in the conductor with the propagating and evanescent modes inside the waveguide. The electric field required for the evaluation of the self reaction is found from the vector potentials which are determined from Helmholtz wave equation with appropriate boundary conditions.

The expressions for the fields and hence the input impedance are derived for any arbitrary termination at the output end of the waveguide. In the case of waveguide radiators the design of transition demands a knowledge of the input admittance seen by the waveguide. The aperture admittance required for the determination of input admittance is formulated in terms of angular spectrum of plane waves. Variation of aperture admittance with its dimensions for a fixed dimensions of exciting waveguide is determined. The results of analysis are used to design :

(i) End launcher for a dominant mode rectangular waveguide terminated in a matched load.

(ii) A radial probe exciting dominant TE_{11} mode circular waveguide terminated in a matched load.

(iii) End launcher for a dominant TE_{11} mode circular waveguide terminated in a matched load.

(iv) End launchers for circular and rectangular waveguide radiators.

The mutual admittance required for the determination of input admittance of a waveguide radiator radiating in the environment of the other elements is also formulated in terms of radial and circumferential components of the Fourier transforms of the electric fields in the two radiating apertures.

A general expression for the mutual admittance between two arbitrary radiators is derived. The results are used for numerical evaluation of mutual admittance between two circular apertures of different diameters and also between two identical circular apertures with arbitrary orientation between the polarization of their excitations.

Comparisons of theoretical results for all above cases with the results of measurements are presented.
