

**ANALYSIS OF SOME COPLANAR WAVEGUIDE AND
DIELECTRIC IMAGE GUIDE STRUCTURES
USING METHOD OF LINES**

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for
the pleasure of

Supreme Personality of Godhead

Lord Sri Krishna

*karmaṇy evādhikāras te
mā phalesu kadācana
mā karma-phala-hetur bhūr
mā te saṅgo 'stv akarmaṇi*

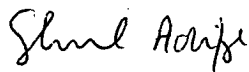
Bhagvad-Gita As It Is (2.47)

TRANSLATION

"You have a right to perform your prescribed duty, but you are not entitled to the fruits of action. Never consider yourself the cause of the results of your activities, and never be attached to not doing your duty".

CERTIFICATE

This is to certify that the thesis entitled "**Analysis of Some Coplanar Waveguide and Dielectric Image Guide Structures Using Method of Lines**" being submitted by R. Rajesh Kumar to the Department of Electrical Engineering, Indian Institute of Technology, Delhi, for the award of the degree of **Doctor of Philosophy**, is a record of bonafide research work carried out by him under our supervision and guidance. The results contained in this thesis have not been submitted to any other university or institute for the award of any degree or diploma.



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Rajesh Kumar Ravulapalli

ABSTRACT

This thesis is concerned with the analysis of some Coplanar Waveguide (CPW) and Dielectric Image Guide (DIG) structures using the semianalytical technique, Method of Lines (MoL). The various CPW structures considered here are Conductor-Backed Coplanar Waveguide (CBCPW), Suspended Coplanar Waveguide (SCPW), and Edge-Coupled CBCPW and SCPW. The different DIG structures studied here are directly connected DIG, single and coupled cladded DIG and single and coupled insulated cladded DIG.

First of all, the dispersion characteristics of single and edge-coupled structures for conductor-backed and suspended configurations have been obtained, including higher order modes, upto 200 GHz. To understand the dispersion behaviour, the frequency dependent field configurations for the first few modes have also been presented. For the coupled structures, frequency dependent characteristic impedance for the dominant and modes has also been obtained.

Next, to improve the isolation and coupling characteristics of a suspended edge-coupled section, different types of dielectric loading, e.g., dielectric loading of outer slots, dielectric loading of conductors, and partial dielectric overlay have been studied. The frequency dependent phase velocity ratio and coupling factor have been calculated. A comparison has been made for the different types of dielectric loading and for the best configuration, the effect of the width of dielectric loading has been studied.

The dielectric loading has also been considered for edge-coupled CBCPW, to avoid synchronous mode-coupling and to improve isolation and coupling characteristics. The dispersion characteristics and characteristic impedance have been obtained for the different types of dielectric loading as mentioned above for the edge-coupled SCPW. The effect of enclosure has also been studied by varying the height and width of the enclosure. Parameter-variation study has been carried out by varying strip and slot widths of an edge-coupled CBCPW.

Finally, accurate dispersion characteristics of directly connected DIG have been obtained including first few higher order modes. A new DIG structure has been proposed, namely, insulated cladded DIG, which is expected to have low conductor and radiation losses. Also, the dispersion characteristics of two coupled structures, i.e., coupled cladded DIG and coupled insulated cladded DIG have been obtained.

In the analysis with method of lines, nonequidistant discretization has also been incorporated to improve flexibility and computational efficiency.

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