

Prediction of Eigenmodes Cutoff Frequencies of Sectoral Coaxial Ridged Waveguides

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Abstract – A mathematical model of sectoral coaxial ridged waveguides has been developed using coupled-integral-equations technique. Maximal ratios of cutoff frequencies of two lowest modes of sectoral coaxial ridged waveguides have been obtained.

Keywords – Sectoral coaxial ridged waveguide, Coupled-integral-equations technique, Cutoff frequency.

I. INTRODUCTION

Ridged structures are widely used in antennas, polarizers, filters, orthomode transducers (OMT). In [1, 2] the construction and characteristics of an OMT using sectoral coaxial ridged waveguides (SCRW) are presented.

Theoretical investigations of ridged circular waveguides have been carried out using different numerical methods: mode matching technique (MMT) [3], magnetic field integral equation [4], coupled-integral-equations technique (CIET) [5]. MMT exhibits the phenomenon of relative convergence, which is absent in CIET. It has been shown in [5] that eigenmodes cutoff frequencies of ridged circular waveguides obtained by CIET converge faster than ones computed by MMT. In this paper we present eigenmodes cutoff frequencies of SCRW calculated by the developed mathematical model and code based on CIET.

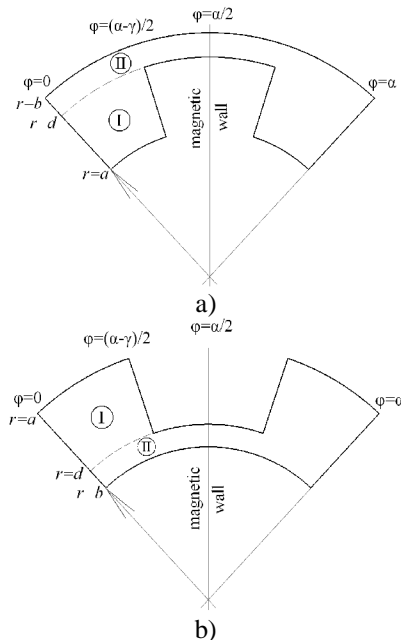


Fig. 1. Two configurations of SCRW:
a – SCRW with ridge on inner wall,
b – SCRW with ridge on outer wall.

II. NUMERICAL RESULTS

The two configurations of SCRW investigated are depicted in Fig. 1. In order to provide maximal ratio of cutoff frequencies of two lowest modes (k_{cr2}/k_{cr1}) the optimization of SCRW has been carried out. The numerical results have shown that for optimal configurations two lowest modes are TE modes. Eigenmodes cutoff wave numbers of optimal SCRW are shown in Fig. 2. The results are in good agreement with ones obtained by CST MS.

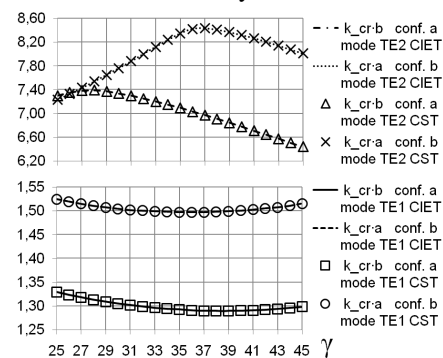


Fig. 2. Eigenmodes cutoff wave numbers of optimal SCRW

III. CONCLUSIONS

Eigenmodes cutoff frequencies of the two SCRW configurations have been computed using CIET. For both configurations maximal ratios of cutoff frequencies of two lowest modes have been obtained. It has been found that the optimal construction of SCRW with ridge on outer wall has bigger outer dimensions than SCRW with ridge on inner wall.

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