

3-D Full-Vectorial Analysis Of Strong Optical Waveguide Discontinuities Using Pade Approximants

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Summary

A full-vectorial 3-D numerical method applicable to high-index contrast optical waveguide discontinuities is presented. Rigorous treatment of the longitudinal boundary condition is incorporated in the formulation. The square root of the characteristic matrix is approximated using Padé approximants which results in an efficient implementation. The biconjugate gradient stabilized method is utilized to iteratively calculate the reflected and transmitted fields. A preconditioner is proposed which results in reduced number of iterations. The proposed method is applied to various optical waveguide facets exhibiting strong transverse and longitudinal refractive index discontinuities. In all cases, the modal reflectivities of the fundamental TE-Like and TM-Like modes are calculated for both the full-vectorial and the semi-vectorial formulations. Significant difference in the calculated modal reflectivity is seen between the full and semi-vectorial models. The error in the power balance remains low in the full-vectorial case irrespective of the waveguide dimensions. However, in the semi-vectorial case, the error in the power balance is found to increase when the waveguide width is reduced.

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