Edge Element and Second-Order Nodal Analysis for Arbitrary Shaped Waveguides

H. Arab [1], F. Afshar[2], C. Akyel[1]

[1]École Polytechnique de Montréal, Montréal, QC, Canada
[2]Department of Electrical and Computer Engineering, McGill University, Montréal, QC, Canada

Abstract

In this project a two dimensional second order nodal and linear edge elements programming model for homogeneous waveguide is developed and simulated in MATLAB® software Environment. The objective is to reduce or eliminate spurious solutions and to cater for any arbitrarily shaped waveguides using triangular edge elements . The formulation is developed using the E-Field and to make use of the edge variables in the Transversal-Plane and the node variables in the Longitudinal-plane. The validity and effectiveness of the proposed method are investigated and compared with the commercial software COMSOL Multiphysics® and analytical solution found in literature. The proposed method is capable of dealing with multitude of configurations with reduced computational complexity and time due to the considerable reduction in mesh size and shape function order.

Reference

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2. Qingsheng Zeng; Delisle, G.-Y., "Characterization of discontinuities and propagation in waveguides using simplified finite element schemes," Radio Science Conference, 2004. Proceedings. 2004 Asia-Pacific , vol., no., pp.84,87, 24-27 Aug. 2004
3. Loveday, P., "Simulation of piezoelectric excitation of guided waves using waveguide finite elements," Ultrasonics, Ferroelectrics and Frequency Control, IEEE Transactions on , vol.55, no.9, pp.2038,2045, September 2008
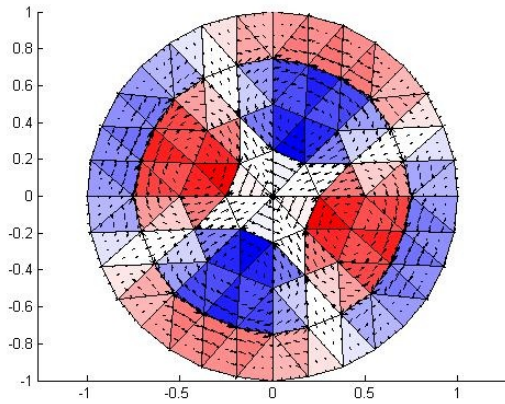
Figures used in the abstract

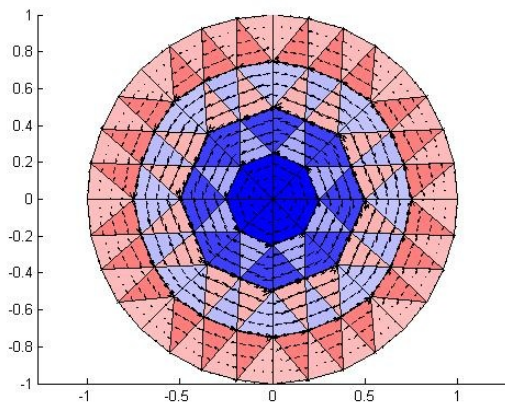**Figure 1**: Field configuration of TE21 modes for circular waveguide.

Figure 2: Field configuration of TE01 modes for circular waveguide.
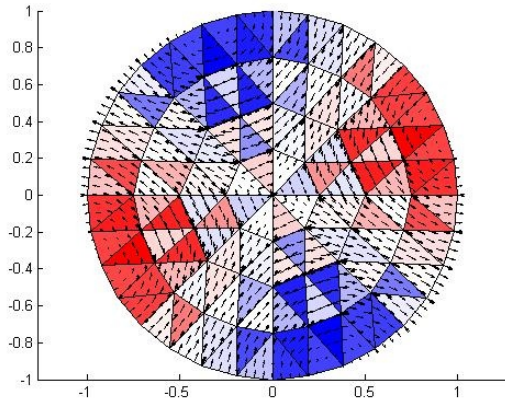
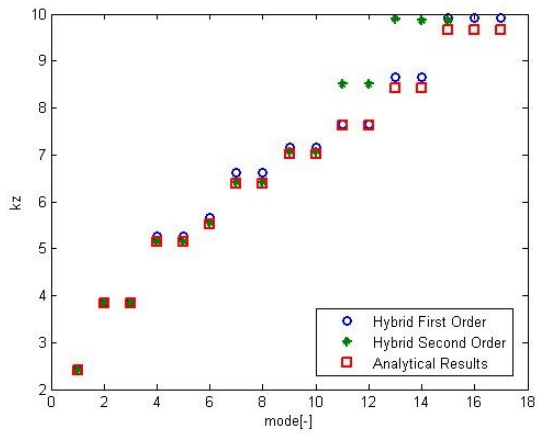**Figure 3**: Field configuration of TE11 modes for circular waveguide.

Figure 4: Comparison between first order and second order nodal with edge element anayisis and analytical results.