VECTOR FINITE ELEMENT MODELING OF PURELY PHYSICAL MODES IN A FERRITE-FILLED CYLINDRICAL CAVITY

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Mocks of a fictitious ferrite.-filled perfectly conducting cavity arc obtained by modeling the fully 3-D electric fields using Whitney edge elements. The cavity is mode.lcd by a tetrahedral mesh with unknowns linked with each lattice edge representing the component of the field tangential 10 that edge. The perfectly conducting walls arc. represented by setting the included tangential electric field values explicitly to zero. A Hermitian matrix [S] is computed by combining the curl of the testing function, curl of electric field, and the Hermitian magnetization tensor. We solve the generalized eigenvalue problem [S]d = k^2 ['J'] (I, for eigenvalues k^2 and electric field coefficient eigenvectors d, where ['1'] is the positive definite matrix formed by combining the testing function and the electric field d i rectl y.

The 20 lowest order physical eigenvalues (5 < k^2 < '25) differ from an anal ytic/trancendental solution by <3% for the case where the cavity is an ax i all y-magnetized cylinder of unit radius, two units altitude, with unit relat ive permeability on the diagonal, ± 0.1 j off diagonal, for finite elements with typical edge length 0.3 units (-1700 unknowns). in addition, a finite number of k^2 -0 modes arc computed, corresponding to the infinite-dimen sioned space of mro-frequency zero-cur] diverge.rm fields admitted by the curl-cur] operator. It is notable that these modes compute 10 values of k^2< 10-5, demonstrating that Whitney elements may be used to represent fields in ferrite media with near-pcxfcct separation of physical and Iron-physical modes. This indicates the ability to model fields in ferrite device and scattering problems with no corruption from vector parasites.