

MEI-55200 Numerical methods for field problems

6. Exercise: electromagnetism

Home exercise: Solve the cavity resonator problem

$$\nabla \times (\mu^{-1} \nabla \times \mathbf{E}) = \omega^2 \epsilon \mathbf{E},$$

in a rectangular domain $0 < (x, y) < L$ with the boundary conditions

$$\mathbf{n} \times \mathbf{E} = \mathbf{0}.$$

Use rectangular 2×2 mesh with linear edge elements.

Split the problem into smaller pieces.

1. Construct the four basis edge interpolation functions for a rectangular element.
2. Use the weak form

$$\int_{\Omega} (\nabla \times \hat{\mathbf{E}}) \cdot (\mu^{-1} \nabla \times \mathbf{E}) dA = \omega^2 \int_{\Omega} \epsilon \hat{\mathbf{E}} \cdot \mathbf{E} dA.$$

to compute the local element contributions.

3. Assembly of the global matrices.
4. Solution of the eigenvalue problem.

To be returned at latest in the next exercise