Finite element computation of optically resonant modes using contour integration techniques

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Recent research in nanophotonics shows an increasing interest in advanced numerical methods to find optically resonant modes. The latter are modeled by a nonlinear eigenvalue problem involving Maxwell's equations. We discretize Maxwell's equations with a finite element method (FEM), and we employ perfectly matched layers (PML) to account for the radiation condition at infinity [1]. We utilize two contour integration techniques in the complex plane to compute the discrete eigenvalues: the Beyn [2] and Feast [3] algorithms.

In this talk, we consider a series of numerical examples in physically relevant 2D nanophotonic systems including small dielectric and metallic particles. Our main contribution is to propose practical guidelines for selecting the FEM and PML parameters, the quadrature points in the complex contour, and choosing the Beyn or Feast algorithm.

References

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