Problem Set #8

A second-order FEM solution on curved triangular cells in 2D is provided on Canvas in the "Sample Codes for Note 16" module. This code uses quadratic Lagrangian basis and testing functions to solve Laplace's equation using the curved-cell formulation described in Chapter 9, Section 9.4 of CEM Note #16.

Capacitance problem:

(1) Use the mesh generator (coaxmeshQ.m) and the FEM program (TriFEMQ.m) provided to generate numerical solutions for the capacitance per unit length of a coaxial cable represented by curved triangles. (The code to do this should be complete.) As in Problem Set #3, generate results for a coax with $b/a = 4$. Generate enough results to determine the convergence rate. Provide a table with numerical solutions for three or more meshes (for instance, use meshes similar to those in Table 1 of Note #3).

Resonant cavity problem:

(2) Using TriFEMQ as an example, develop a new code that determines the TM modes of a cavity using the curved-cell quadratic representation. This should be a code similar to that you generated for Problem Set #4, but based on the curved triangular meshes produced by coaxmeshQ.m and the quadratic basis functions provided in TriFEMQ.m. Provide a listing of the new code.

(3) Generate at least 3 different results for the 3 lowest TM resonant wavenumbers for a coaxial cavity with PEC walls with inner radius $a = 1.0$ and outer radius $b = 4.0$. Provide a table with your results.