MATH 525

Project Proposal

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Problem Setup

I plan to solve 2D Poisson equation with Dirichlet boundary conditions:

$$\Delta u = f \quad in \quad \Omega,$$
$$u = 0 \quad in \quad \partial\Omega\,.$$

I plan to use the Finite element method to solve this PDE.
The f will be picked up carefully so that we have the exact solutions to compare with the numerical solutions.

Language

I plan to use C to do the implementation.

Parallelization

- Assembly Stiffness matrix and force vector
  - Use OpenMP to calculate the local stiffness matrix and local force matrix inside different threads and sum them up to be the global stiffness matrix and global force matrix.
- Solving Linear System
  - Use conjugate gradient to solve the linear system so that it can be parallelized.
- Visualization: generate Tecplot or Paraview files
  - Use MPI to generate solution files separately and for the visualization, we need to load files generate by different processors together in Tecplot and Paraview to obtain the visualization we want.