# Math 5521 Computational Project 2

Spring, 2018

The goal of this project is to test the convergence of the LDGFEM, using FreeFem++. It is essentially the same as project 1, just changing the numerical method and comparing results.

- Look at the example convects.edp in the examples++-chapt3 directory and the discussion of this in the manual. Actually, most details are not essential. It may help to understand the "jump", "intalledges" and "nTonEdge" commands. Also, there is a command "mean", analogous to "jump", but for averages on edges.
- You will modify your project 1 code to solve the same problems of the general form
$$-\nabla \cdot K\nabla p = f \text{ in } \Omega,$$
$$p = g \text{ on } \partial\Omega.$$
- Use P1dc (first-order discontinuous polynomial) spaces and implement the local DG method with the following parameters:
  - $\delta_1 = h^{-1}$, $\delta_2 = 0$ and $\vec{\delta}_3 = 0$.
- You can delete the pressure penalization term
$$\epsilon \int_\Omega p\, q\, dx.$$
- Reuse the same file names as before, just keep your code in a separate directory from your project 1 code.
- Perform the same tests outlined in project 1, now with your LDG code. You may skip the pressure error plots and their discussion.
- In addition, for the case $p = x^3 + y^3$, also test convergence using P2dc elements. Only use four meshes; the linear solver dies on the fifth mesh. Note that using RT0 on the fifth mesh requires 128,320 degrees of freedom, but LDG with P2dc on the third mesh requires only 57,600.
- Present and discuss the convergence results, comparing with the results using RT0 elements from project 1 (where possible). No need to show me the results you got for project 1 again, just refer to them.