Preliminary Written Test
on Computational Fluid Dynamics
Handed out: February 12, 2016
Due: February 29, 2016

In project 1 of your MAE766 class, you were requested to solve Laplace equation using a linear continuous Galerkin finite element method (CG(P_1)). In this written test, you are asked to use a linear discontinuous Galerkin finite element method (DG(P_1)) to solve Laplace equation. This written test is intended to assess and augment your understanding of the discontinuous Galerkin finite element methods, which can also be used to solve elliptic problems.

1. Write a program to solve 2D Laplace equation using a linear discontinuous Galerkin finite element method (DG(P_1)) on unstructured grids, where the diffusive fluxes are computed using Bassi-Rebay II scheme.

2. Use your code to compute an internal potential flow past a channel with a circular bump on the bottom. Assume the freestream velocity vector is (1,0). Plot the computed velocity potential and velocity magnitude contours in the flow field. Draw the velocity distributions on the bottom and top surfaces of channel. The required mesh can be downloaded from MAE766 course website: http://www.mae.ncsu.edu/luo/courses/mae766/index.html

3. Email me your code and a short report.

References

1. F. Bassi, A. Crivellini, S. Rebay, and M. Savini, Discontinuous Galerkin Solution of the Reynolds-averaged Navier-Stokes and k-ω turbulence model equations, **Computers & Fluids**, Vol. 34, No. 4–5, pp. 507-540, 2005.

Note : If you need your CG(P1) code from project 1 of my MAE766 class, I can email it to you.