# The Hong Kong Polytechnic University
# Department of Applied Mathematics

# Colloquium

**On**

# First Order Least Square Method with Ultra-weakly Imposed Boundary Condition for Convection Dominated Diffusion Problems

**by**


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### Abstract


We present and analyze a first order least square method for convection dominated diffusion problems, which provides robust L2 a priori error estimate for the scalar variable. A key feature of the method is that there is no stabilization parameter chosen empirically. The novel theoretical approach is to rewrite the method in the framework of discontinuous Petrov Galerkin (DPG) method, and then show numerical stability by using a key equation discovered in "An analysis of the practical DPG method" by Jay Gopalakrishnan and Weifeng Qiu. This new approach gives an alternative way to do numerical analysis for least square methods for a large class of differential equations. Our convergence result shows that there is L2 convergence rate of scalar variable even if the given data f in L2. We also show that the spectral condition number of the global matrix is independent of the diffusion coefficient. In addition, Dirichlet boundary condition is imposed in an ultra-weak way. Numerical experiments verify our theoretical results and, in particular, show our way of imposing Dirichlet boundary condition is essential to the design of least square methods - numerical solutions on subdomains away from interior layers or boundary layers have remarkable accuracy even on coarse meshes, which are unstructured quasi-uniform.


**Date : 11 April, 2014 (Friday)**
**Time : 2:30 p.m. – 3:30 p.m.**
**Venue : TU717, The Hong Kong Polytechnic University**

*** * * ALL ARE WELCOME * * ***