Department of Mathematics Colloquium

Professor Dongwoo Sheen

February 06, 2015 from 3:00 to 4:00 pm at DERR 329

Title : Stable cheapest nonconforming finite element methods for the Navier-Stokes equations

We will begin by a short review on the recent development in nonconforming finite elements on rectangular/quadrilateral/hexahedral domains. A nonconforming quadrilateral element for the biharmonic problem will be introduced, which generalizes the incomplete biquadratic element on rectangles, also the well-known Morley nonconforming element on triangular triangulations. The fourth-order biharmonic equation occurs in the modeling creeping flows and deflection of thin plates. A piecewise linear quadrilateral element is applied to approximate the velocity field of the Stokes equations with the piecewise constant element to approximate pressure field. We examine the discrete inf-sup condition for these elements. Finally, we introduce a stable cheapest finite element pair for solving the Stokes equations. We discuss the lowest cost and simplicity of the proposed method. The stable cheapest finite element method with a slight modification will be then applied to solve a driven cavity problem. Some numerical comparisons ensures the simplicity and superiority over other finite element methods. This talk is based on several pieces of joint works with Chunjae Park (Konkuk Univ.), Hyun Nam (Korea Institute of Atmospheric Prediction System), Sihwan Kim & Hyung Jun Choi (Samsung), Roktaek Lim & Jaeryun Yim (SNU).

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Dongwoo Sheen is a professor at Dept. of Math. Seoul National Univ, Seoul, Korea. He received his BSc and MSc from the Dept. of Math. at Seoul National University. He worked for Samsung Electronics for a year, and moved to the USA to study Applied Mathematics further. He received his PhD under the guidance of Jim Douglas, Jr. at Purdue University in 1991. He was a postdoctoral research fellow at the University of Pavia, Italy and Purdue University. In 1993 he joined Seoul National University where he is currently a full professor of Mathematics and the Interdisciplinary Program in Computational Science and Technology. He held visiting professorship at New South Wales University in the year of 1999 Purdue University in 2006-2007, and Texas A & M University in 2013-2014. His research interests include Numerical Analysis and Scientific Computation in several application areas including fluid and solid mechanics, electrodynamics, math finance, and math biology. Specifically he has contributed in developing several fundamental nonconforming finite element methods and parallel algorithms based on Laplace transform.