Faculty Distinguished Lecture

The Interplay Between Computation and Analysis of the 3D Euler and Navier-Stokes Equations

by Professor Thomas Yizhao Hou

Abstract

Whether the 3D incompressible Euler equations can develop a singularity in finite time from smooth initial data is one of the most challenging problems in mathematical fluid dynamics. This is closely related to the Clay Millennium Problem on 3D Navier-Stokes Equations. We first review some recent theoretical and computational studies of the 3D Euler and Navier-Stokes equations. Our study suggests that the convection term could have a nonlinear stabilizing effect for certain flow geometry. We then present strong numerical evidence that the 3D Euler equations develop finite time singularities. A careful local analysis also suggests that the blowing-up solution is highly anisotropic and is not of Leray type. A 1D model has been proposed to study the mechanism of the finite time singularity. Very recently we prove rigorously that the 1D model develops finite time singularity.

Biography

Professor Thomas Yizhao Hou is the Charles Lee Powell professor of applied and computational mathematics at Caltech and a world renowned applied mathematician. He obtained his Ph.D. in Mathematics from UCLA in 1987 and joined Courant Institute as a junior faculty member from 1989 to 1993. He moved to Caltech in 1993, served as the department chair of Applied and Computational Mathematics from 2000 to 2006. Prof. Hou has received a number of honors and awards, including Fellow of American Academy of Art and Sciences (2011) and an inaugural Fellow of Society of Industrial and Applied Mathematics (2009) and American Mathematical Society (2012). He was also an invited speaker of International Congress of Mathematicians (1998) and an invited plenary speaker of International Congress of Industrial and Applied Mathematics (2003), the founding Editor-in-Chief of the SIAM Journal on Multiscale Modeling and Simulation from 2002 to 2007, and the Chairman of the Board of Governors of the Institute of Mathematics and its Applications from 2012 to 2013.

Date: 5 November 2014 (Wednesday)
Time: 4:00 – 5:00pm (tea reception at 3:30pm)
Venue: Room Y305, PolyU

ALL ARE WELCOME!

For enquiry, please contact Miss Eunice Hung at 3400 3908 or eunice.hung@polyu.edu.hk

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

FACULTY OF APPLIED SCIENCE & TEXTILES

DEPARTMENT OF APPLIED MATHEMATICS 應用數學系