Thomas Yizhao Hou won William Benter Prize in Applied Mathematics 2024

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Professor Thomas Yizhao Hou, Charles Lee Powell Professor of Applied and Computational Mathematics, California Institute of Technology, US, won the William Benter Prize in Applied Mathematics 2024.

Professor Hou, an outstanding applied mathematician with exceptional strengths in both numerics and analysis, has made pioneering and ground-breaking contributions in several areas of applied mathematics. For fluid interface problems, Professor Hou and collaborators developed the Small Scale Decomposition method which has many applications ranging from fluid dynamics to materials science and biology. The first level set method to study incompressible multiphase flows was developed by Chang, Hou, Merriman and Osher in 1996. The work has generated a significant impact in the computational fluid dynamics community.

The Multiscale Finite Element Method (MsFEM) developed by Hou and Wu in 1997 has generated a considerable impact in both the applied math and engineering communities. Some major oil companies have adopted a version of MsFEM in their next generation flow simulators. The Generalized Multiscale Finite Element Method (GMsFEM) developed by Efendiev, Galvis and Hou is another remarkable contribution. The GMsFEM has been used to derive macroscopic equations for a variety of applications and has found many applications in geoscience and materials science. It also provides a rigorous justification for the widely used multicontinuum theories in the engineering community.

Whether the 3D incompressible Euler equations can develop a finite time singularity from smooth initial data is considered as one of the most challenging problems. Professor Hou and collaborators established a localized non-blowup criterion for 3D Euler equations, discovered and analyzed the surprising stabilizing effect of advection, and proved the existence of globally smooth solutions for the 3D Navier-Stokes equations with large smooth initial data of finite energy. In 2014, Lou and Hou discovered a new blowup scenario for the 3D axisymmetric Euler equations with boundary. They designed an extremely effective adaptive mesh strategy to achieve a remarkable level of resolution, and obtained strong numerical evidence of finite time singularity. Recently, Professor Hou and his former PhD student, Jiajie Chen, made a major breakthrough by providing a rigorous computer-assisted proof of the Hou-Luo blowup scenario. Their method is very powerful and it can be potentially used to study self-similar blowup of other nonlinear PDEs. Very recently, Professor Hou made another important breakthrough by discovering a new class of potentially singular solutions of the axisymmetric Navier-Stokes equations.

For his outstanding contributions in applied mathematics, Professor Hou has received many honors and awards. He was an ICM invited speaker in 1998 and a plenary speaker of ICIAM in 2003. He was elected to Fellow of American Academy of Arts and Sciences in 2011, an inaugural SIAM and AMS Fellow. He also co-founded the highly influential SIAM interdisciplinary Journal on Multiscale Modelling and Simulation Journal in 2002.

The William Benter Prize will be presented during the opening ceremony for the International Conference on Applied Mathematics (ICAM 2024), which is co-organized by the Liu Bie Ju Centre for Mathematical Sciences (LBJ) and the Department of Mathematics of City University of Hong Kong.

The William Benter Prize in Applied Mathematics was set up by LBJ in honour of Mr William Benter for his dedication and generous support to the enhancement of the University's strengths in mathematics. The prize recognizes outstanding mathematical contributions that have had a direct and fundamental impact on scientific, business, finance and engineering applications. The cash prize of US$100,000 is given once every two years.

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