

Moving Grid Methods and their Applications in Higher Dimensions

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School of Physical and Mathematical Sciences

In this talk, we present an adaptive moving grid strategy for partial differential equations in two-space and three-space dimensions. The algorithm automatically adjusts the size of the finite elements in the physical domain to resolve the relevant scales in multi-scale physical systems while minimizing computational costs. Some subtle issues in the moving mesh scheme, in particular the solution interpolation from the old mesh to the new mesh and the choice of monitor functions will be addressed. Since the mesh redistribution procedure normally requires solving large size matrix equations (arising from discretizing the Euler-Lagrange equations or a minimization problem), we will describe a procedure to decouple the matrix equation to a much simpler block-tridiagonal type which can be solved by multi-grid methods efficiently. To demonstrate the performance of the proposed moving mesh strategy, the algorithm is implemented in moving finite element computations for multiphase flows and dendritic growth simulations. Numerical results on two-dimensional and three-dimensional simulations will be presented.

Speaker Biography

Professor TANG Tao is Chair Professor of Department of Mathematics, Director of Graduate School and Director of Peking University - HKBU Joint Research Institute for Applied Mathematics, Hong Kong Baptist University. Prof. Tang's research interests span many areas, including numerical analysis, computational fluid dynamics and nonlinear integral-differential equations. In 2007, Prof. Tang received the Hong Kong and Macau Young Scholars Collaborative Research Fund by the National Science Foundation of China (NSFC). With effect from January 2008, Prof. Tang has entered into a three-year collaborative research with Institute of Computational Mathematics of the Chinese Academy of Sciences. Prof. Tang has authored and co-authored more than 80 publications in key scientific journals such as *Journal of Computational Physics*, *Journal of Computational and Applied Mathematics*, *Applied Numerical Mathematics* etc. He sits on the editorial boards of various international journals, including, *Computers and Fluids*, *Journal of Computational Mathematics* and *Mathematics of Computation*. He is also a co-Managing Editor of *Communications in Computational Physics*, which has published original research and survey papers of high scientific value in computational modeling of physical problems since 2006.

Host: Mathematical Imaging and Vision Research Group, Division of Mathematical Sciences, School of Physical and Mathematical Sciences

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