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Oleg V. Vasilyev 教授講演会

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講演題目：**Volume Penalization Methods for Flow Simulations in Complex Geometries**

講師： **Prof. Oleg V. Vasilyev (Center for Design, Manufacturing and Materials at Skolkovo Institute**

of Science and Technology, Moscow, Russia)

日時： **2017 年 3 月 28 日（火）13:30～15:00**

場所： **大阪大学工学研究科機械工学専攻 M3 棟 3 階 M3-213 セミナー室**

講演概要：

In order to treat flows around obstacles of complex geometries several techniques are used, such as body conformal grids, immersed boundary and volume penalization methods. While body fitted grids allow for exact boundary conditions to be imposed along the surface, grid meshing and re-meshing can be quite expensive and typically preclude the use of rectilinear grids. Moving and deforming obstacles are particularly problematic as they necessitate grid adaptation at every time step. Immersed boundary methods avoid the cost and complications of body fitted meshing by introducing the effects of obstacles through manipulation of the discretized equations. These methods are highly problem specific and depend greatly upon the discretization and the numerical method used. On the other hand, volume penalization methods imposes the effects of solid bodies by introducing forcing terms on the constitutive equations before discretization and are therefore highly flexible for different solvers and numerical techniques. This talk provides an overview of volume penalization methods for both viscous and inviscid compressible and incompressible flows around obstacles of complex shape with moving or deformable surfaces. Two types of volume penalization methods are described: Brinkman-type and characteristic-based volume penalization. Brinkman-type volume penalization methods model solid obstacles as porous media with porosity and viscous permeability approaching zero. The main weakness of Brinkman-type volume penalization approaches is the inability to approximate general boundary conditions, since they are limited to Dirichlet and homogeneous Neumann boundary conditions. The characteristic-based volume penalization approach generalizes Brinkman-type volume penalization and adds the flexibility to impose both Neumann and Robin type boundary conditions by introducing hyperbolic penalization terms with characteristics pointing inward on solid obstacles. The boundary conditions can be imposed for both conservative and primitive variables. The main advantage of volume penalization methods, both Brinkman-type and characteristic-based is that they provides a systematic control error of approximation of the boundary conditions. The error estimates for different formulations are provided. The generality of the approach is demonstrated for variety of flow configurations and a discussion on how to enhance volume penalization approach by combining it with adaptive mesh refinement methods, such as adaptive wavelet methods, is given.

講師略歴:

Prof. Oleg V. Vasilyev, is a Professor of Center for Design, Manufacturing and Materials at Skolkovo Institute of Science and Technology, Moscow, Russia, which he joined recently. He received the MS degree in Applied Mathematics and Physics from Moscow Institute of Physics and Technology in 1991, and the MS and PhD degrees in Mechanical Engineering from the University of Notre Dame, in 1994 and 1996, respectively. Prior to joining the Skolkovo Institute of Science and Technology, Prof. Vasilyev was a Professor of Mechanical Engineering at the University of Colorado Boulder and the director of Multiscale Modeling and Simulation Laboratory (2002-2017), an Assistant Professor in the Department of Mechanical and Aerospace Engineering, University of Missouri - Columbia (1998-2002) and Research Fellow at the Center for Turbulence Research, Stanford University (1996-1998). Prof. Vasilyev conducts research in the general area of theoretical and computational fluid mechanics with the emphasis on the creation of novel approaches for modeling and simulation of complex flows, development of low order "physics-capturing" models and robust computational methodologies with tight integration of the numerics and physics-based modeling, and applications of these novel approaches to multi-scale/multi-physics fluid problems of engineering and scientific interest. Prof. Vasilyev is the author and co-author of more than 100 peer-reviewed journal and conference publications. Prof. Vasilyev has given more than 200 lectures at conferences and universities around the world. Prof. Vasilyev is a Fellow of both the American Physical Society and the American Society of Mechanical Engineers, and the recipient of Fredric William Basel Research Award from Alexander Von Humboldt Foundation.

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会場案内

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会場周辺 ↓

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