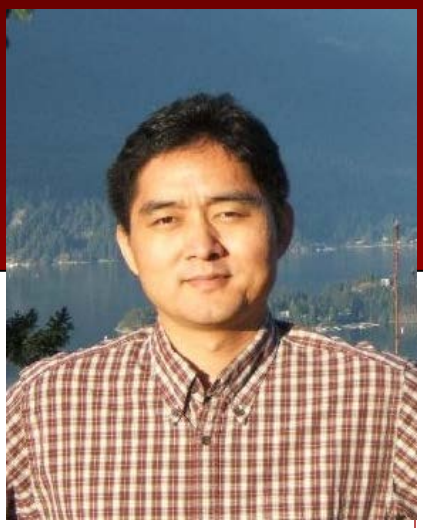

Department of Mathematical Sciences welcomes

Pengtao Sun
University of Nevada

Numerical studies for unsteady moving interface problems and applications to fluid-structure interactions (FSI)

ABSTRACT:

In this talk, I will present our recent numerical methodology studies for unsteady moving interface problems and applications to dynamic fluid-structure interaction (FSI) problems. Our numerical methodologies include the body-fitted mesh method (arbitrary Lagrangian-Eulerian (ALE) method) and the body-unfitted mesh method (distributed Lagrange multiplier/fictitious domain (DLM/FD) method), combining with the mixed finite element approximation. A fully coupled (monolithic) mixed finite element method is developed for all numerical methodologies to unconditionally stabilize numerical computations for moving-interface problems. Convergence theorems conclude those numerical analyses with an optimal convergence in regard to the regularity assumption of real solutions. All theoretical results are validated by numerical experiments as well. In particular, I will also present a new type of monolithic ALE-FEM for the parabolic/mixed parabolic interface problem, towards a dynamic fluid-poroelastic-structure interaction (FPSI) problem—a type of important hemodynamic problem. Corresponding stability and optimal convergence analyses are carried out for this method in semi- and fully discrete scheme. Both ALE (affine) mapping and Piola mapping play crucial roles in the development of this method for a unsteady interface problem in which a H(div)-type mixed problem is involved. All theoretical results are validated by numerical experiments as well. Our well-developed ALE method has been successfully applied to several realistic dynamic FSI problems in the fields of hydrodynamics and hemodynamics. Some numerical animations will be shown in this talk to illustrate that the proposed and well-analyzed numerical methods can produce high fidelity numerical results for realistic FSI problems in an efficient and accurate fashion.

ABOUT THE SPEAKER:

Dr. Pengtao Sun is a Full Professor of Department of Mathematical Sciences in University of Nevada, Las Vegas (UNLV). Dr. Sun obtained his PhD degree from Institute of Mathematics, Chinese Academy of Sciences in 1997. Before joining University of Nevada in 2007, he worked as Research Scientist, Postdoctoral Fellow, Research Associate and Assistant Professor in Chinese Academy of Sciences, Hong Kong Polytechnic University, Pennsylvania State University and Simon Fraser University. Dr. Sun's primary research fields are Numerical Solutions of Partial Differential Equations, and Scientific and Engineering Computing with applications to miscellaneous multiphysics problems in the fields of solid mechanics, fluid dynamics, fuel cell dynamics, fluid-structure interactions, hemodynamics, electrohydrodynamics, etc. Dr. Sun's research has been continuously supported by National Science Foundation and Faculty Opportunity Awards (UNLV) since 2008. Dr. Sun was the recipient of Distinguished Researcher Award at College of Sciences, UNLV in 2016.

September 28, 2018

Hosted by:
Prof. Luoding Zhu

Tea begins at 2:30
in LD 259

Research Topic
begins at 3:00
in LD 229

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