IOWA STATE UNIVERSITY

Center for Multiphase Flow Research and Education

Multiscale, Multiphysics, and Multiresolution Computing in Science and Engineering

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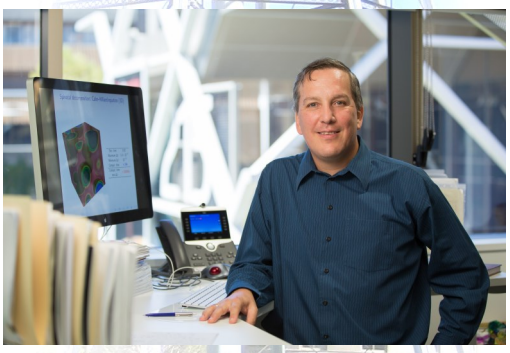
Abstract

Computational methods are fundamental in the development and design processes in modern-day engineering. Multiscale and multiphysics processes are challenging for state-of-the-art computational methods. For example, the simulation of extremely complex flows requires a significant amount of computational resources as well as sophisticated models and numerical methods to deliver reliable results. Over the last decades, considerable efforts attempted to develop computational techniques that overcome difficulties encountered by classical discrete approximations (e.g., finite differences, finite volumes, and finite elements) when dealing with such coupled) flow problems. After a brief review of the main contributions to these areas by my group and collaborators, we will describe an adaptive stabilized finite element method based on residual minimization. We propose a new class of stabilized finite element (FE) methods. The discretization is a non-conforming Discontinuous Petrov-Galerkin (DPG) method where the test space is discontinuous, and the trial space is a subspace of this test space. This restriction to a subspace grants several desirable properties to the discrete solution. For example, we can use a continuous trial space that delivers a discretely stable solution and a robust error estimator for on-the-fly adaptivity. We will use several model problems in 2D and 3D to validate our theoretical results.

Biography

Dr Victor Manuel Calo is a John Curtin Distinguished Professor at Curtin University. Dr Calo holds the CSIRO Professorial Chair in Computational Geoscience and is a highly cited researcher who is actively involved in disseminating knowledge: Dr Calo has authored 200+ peer-reviewed publications. Dr Calo holds a professional engineering degree in Civil Engineering from the University of Buenos Aires. He received a master's in Geomechanics and a doctorate in Civil and Environmental Engineering from Stanford University. Dr Calo's research Interests include modeling and simulation of geomechanics, fluid dynamics, flow in porous media, phase separation, fluid-structure interaction, solid mechanics, and high-performance computing.



Refreshments will be provided.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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