

Computational mathematics: From wave-structure interaction to magnetic equilibrium in fusion reactors

The first half of the talk will be devoted to the problem of time-domain wave scattering by elastic obstacles. In this situation, part of the incident wave is scattered off the obstacle and part of it excites a perturbation that propagates throughout the solid. Mathematically, this results in two equations coupled through transmission conditions at the interface. I propose a formulation that couples boundary integral equations with partial differential equations inside the scatterer.

The second part of the talk pertains an application coming from plasma physics. In axially symmetric magnetic confinement devices, the equilibrium between magnetic and hydrostatic forces can be formulated in terms of a free boundary problem involving a semi-linear elliptic equation for a scalar potential posed in free space. Given a reactor configuration and the location and intensities of the external coils, the total magnetic field and the location of the plasma have to be determined.

In order to deal computationally with the unbounded domain, an artificial boundary containing the reactor is introduced and the exterior problem is reformulated as an integral equation. The location and properties of the plasma boundary depend on external parameters (location and current intensities in the coils, material properties of the reactor, etc.) which are subject to variability. A satisfactory solution must therefore also address and quantify the uncertainty due to the stochasticity in the problem parameters.

Thursday, 1/23/2020

3:00pm 4:30pm

COB I, Rm. 263 For more information, contact: Professor Mayya Tokman at mtokman@ucmerced.edu

Tonatiuh Sánchez-Vizuet Courant Institute of Mathematical Sciences

New York University

Tonatiuh Sánchez-Vizuet earned a Bachelor's degree in Physics from the National Autonomous University of México (UNAM) in 2010 and a Master's degree in Mathematics from the same institution in 2011. He obtained a Doctoral degree in Applied Mathematics from the University of Delaware in 2016. Since then, he has been a Postdoctoral Scholar at the Courant Institute of Mathematical Sciences. His research interests are in Numerical Analysis, Scientific Computing and Computational Physics. In particular, the development of numerical methods for time domain integral equations (BIEs), hybridizable discontinuous Galerkin methods for partial differential equations (PDEs) and the coupling of PDE-BIE discretizations.

