POLITECNICO DI TORINO

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange

ECCELLENZA 2018 • 2022

Wednesday the June 26, 2019 at 10:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

Nabil ATALLAH

PhD student at Duke University

The Shifted Boundary method: From Darcy Flow to Solid Mechanics

Prof. Claudio Canuto introduces the seminar

Abstract

Embedded methods obviate the need to mesh the geometry by immersing it in a preexisting grid. However, the ease in mesh generation comes at the expense of boundary condition enforcement at the mathematical and data structure levels. Unfortunately, standard embedded boundary methods suffer from the small-cut grid cells, which have adverse effects on the algebraic solve and are difficult to implement due to the need to perform complex cell cutting operations at boundaries.

In this seminar, dr Atallah presents a new, stable, and simple embedded boundary method, called "Shifted Boundary" method (or, in short, SB method), that eliminates the long-standing numerical issues mentioned above by defining a surrogate domain consisting of all un-cut elements of the mesh that lie inside the computational domain. To correct for the discrepancy between the true and surrogate boundaries, while avoiding a reduction in convergence rates and maintaining consistency with the original problem-definition, a Taylor extrapolation at the surrogate boundary was enforced through Nitsche's method. He will demonstrate and perform a numerical analysis of the SB method for the Darcy flow and solid mechanics equations.

Biography

Nabil Atallah is a PhD candidate in Civil and Environmental Engineering at Duke University under the supervision of Professor Guglielmo Scovazzi. He received his BE in Civil and Environmental Engineering with high distinction, with a minor degree in Mathematics from the American University of Beirut in 2013; he received his ME in Water Resources and Environmental Engineering from the same university in 2015, where he received the Abdul Hadi Debs award for academic excellence. His current research interest is developing embedded/immersed algorithms for solid mechanics applications.