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h 11:00, Aula MS1 (DICAr)

From Shells to Stratified Flows: Expanding the Role of Isogeometric Analysis in Computational Mechanics

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Isogeometric Analysis (IGA) was originally introduced to bridge the gap between computer-aided design and computational analysis, and it has had a major impact on structural mechanics through its ability to represent complex geometries accurately and provide smooth, higher-order basis functions. While many of the early successes of IGA were in shells, solids, and structural mechanics, its advantages extend well beyond these applications.

In this seminar, I will discuss how IGA can be used as a powerful framework for fluid mechanics. I will begin with selected examples from structural mechanics, including geometrically complex shell and composite structures, to illustrate the core ideas and benefits of IGA. I will then focus on fluid applications, where smooth basis functions, higher-order continuity, and accurate geometry representation offer important advantages for turbulent flows, atmospheric flows over complex terrain, and renewable-energy systems. I will present recent work from our group on stabilized and variational multiscale formulations using IGA for incompressible and stratified turbulent flows, including atmospheric boundary-layer simulations and flows over complex terrain. Particular attention will be given to the role of IGA in resolving near-wall physics, representing terrain geometry, and supporting robust multiscale turbulence modeling.

The seminar will highlight the broader message that IGA should not be viewed only as a structural mechanics technology, but as a general computational platform for complex multiphysics problems. By combining accurate geometry, smooth approximation spaces, stabilized formulations, and modern high-performance computing, IGA provides a promising path toward predictive simulations in fluid mechanics, renewable energy, aerospace, and environmental flows.

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