TALK: Hierarchical Model reduction: core concepts and current trends

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ABSTRACT:

Hierarchical Model Reduction (HiMod) is a discretization method that allows to reduce a 3D/2D problem exhibiting a main directionality (e.g., flows in pipelines) to a system of coupled 1D problems [1]. HiMod relies on the separation of variables paradigm, by discretizing the leading and the transverse directions in a different way. Specifically, the leading direction is approximated by employing IsoGeometric Analysis [2], while the transverse direction is resolved through a customized modal basis [3], according to a hierarchal structure of function spaces. HiMod technique results in significant computational advantages that make this model order reduction particularly suitable for diverse application settings [2,4], where flows with a primary directionality play a crucial role.

In this presentation, we provide a state-of-the-art overview of HiMod, highlighting recent advancements in both theoretical foundations and computational tools. We will focus on the modelling of fluid dynamics problems through the Stokes and the Navier-Stokes equations, by establishing a rigorous rule to select the HiMod approximation (i.e., the number of modes together with the IsoGeometric approach for both pressure and velocity) in order to guarantee the numerical stability of the HiMod discretization. In addition, some recent instances of application fields where HiMod modelling has been successfully employed will be provided.

REFRENCES:

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