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BOUNDARY LAYER TREATMENT WITHIN A PGD STRATEGY.

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Capturing boundary layer effects becomes crucial when determining the aerodynamic response of a system. Indeed, this extremely narrow region is responsible of generating most of the drag resistance force just like the location of detachment points. Fluid flows in such degenerated geometries, in which the characteristic length in one direction is much smaller than in the others, are a challenging task for standard mesh-based simulation techniques, that often require a tremendous number of discretization points or elements to provide accurate and stable resolutions. Classically, ad-hoc simplifications or approximations (e.g. boundary layer theory, wall functions) are rather called for in order to conduct affordable simulations.

In this work, we consider, within the Proper Generalized Decomposition (PGD) framework, a parameterization of the boundary layer region constructing an off-line solution manifold of the Navier-Stokes equations. The use of such separated representation allows a high-resolution representation of the solution evolution along the set of parameters controlling the boundary layer region while keeping the computational complexity characteristic of standard spatial simulations. Once the solution manifold is constructed, it can be used online within a domain decomposition strategy reducing the complexity of the boundary layer treatment while keeping her effect onto the outer region.

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