Boundary Control and Data Assimilation for Navier–Stokes Flows with Applications to Hemodynamic

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Abstract

In this talk we will present recent results on optimization problems associated with fluid flows governed by the Navier–Stokes equations, with applications to blood flow modeling.

First, we consider an optimal boundary control problem for the steady Navier–Stokes equations with mixed boundary conditions. We addressed the issue of correctly adjusting boundary conditions at artificial boundaries in truncated domains. In particular we study the minimization of a velocity tracking functional with controls acting on part of the boundary, combined with non-standard outflow conditions of the type directional do-nothing.

We then discuss a data-assimilation framework for time-dependent blood flow simulations, where boundary data are optimized using time-series observations. The proposed approach reduces the discrepancy between simulated and observed data and improves the reconstruction of relevant flow quantities such as velocity, pressure, and wall shear stress, even in the presence of noise.

References

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