Goal-adaptivity for fluid-structure interaction

Harald van Brummelen (Eindhoven University of Technology), K.G. van der Zee, P.W. Fick, V.V. Garg, S. Prudhomme

The numerical solution of fluid-structure-interaction problems poses a paradox in that most of the computational resources are consumed by the subsystem that is of least practical interest, viz., the fluid. Goal-adaptive discretization methods provide a paradigm to bypass this paradox. Based on the solution of a dual problem, the contribution of local errors to the error in a specific goal functional is estimated, and only the regions that yield a dominant contribution are refined.
In this presentation, I will discuss recent progress in the development of goal-adaptive approximation methods for fluid-structure interaction and, more generally, boundary-coupled problems and free-boundary problems. In general, two fundamental complications must be addressed to apply goal-adaptive methods to fluid-structure interaction. Firstly, the formulation (interpretation) of the interface coupling conditions has non-trivial consequences for the dual problem [1-3]. Secondly, the domain dependence engendered by the free-boundary character results in complicated shape derivatives in the linearized dual problem [3-5]. The presentation addresses both these complications. Numerical results are presented to illustrate the differences in the various formulations, and to exhibit the potential of goal-adaptive methods for fluid-structure-interaction problems.

References

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