Coupling Navier-Stokes and Darcy equations: an overlapping approach

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ABSTRACT

In this talk we consider the Navier-Stokes/Darcy problem modeling the filtration of incompressible fluids through porous media. To realize this coupling we use the so-called Interface Control Domain Decomposition (ICDD) method proposed in [1, 2]. The global computational domain is split into two overlapping subdomains in which we solve Navier-Stokes and Darcy equations, respectively, and the overlap corresponds to the transition region between the two regimes. ICDD introduces new auxiliary control variables on the subdomain internal boundaries (named interfaces) that play the role of the unknown traces of the Stokes velocity and Darcy pressure. Such controls are determined by minimizing a suitable cost functional that measures the jump of the quantities of interest at the interfaces of the decomposition. As a matter of fact we solve an optimal control problem in which both controls and observation are defined on the interfaces and whose constraints are the PDE's on the overlapping subdomains ([3]). In this talk we discuss both theoretical and computational aspects of the ICDD method applied to Stokes-Darcy coupling, and we show some numerical results with the aim of comparing our approach with classic coupling techniques based on non-overlapping decompositions and the Beavers-Joseph-Saffman interface conditions.

REFERENCES

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