Coupling non-conforming approximations of PDEs by means of spectral Lagrange multipliers

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ABSTRACT

This work focuses on the development of a non-conforming method for the coupling of PDEs based on weakly imposed transmission conditions: the continuity of the global solution is enforced by a finite number of Lagrange multipliers defined over the interfaces of adjacent subdomains. The method falls into the class of primal hybrid methods, which include also the well-known mortar method. Differently from the mortar method, we discretize the space of basis functions on the interface by spectral approximation independently of the discretization of the two adjacent domains. In particular, our approach can be regarded as a specialization of the three-field method in which the spaces used to enforce the continuity of the solution and its conormal derivative across the interface are taken equal. One of the possible choices to approximate the interface variational space – which we consider here – is by Fourier basis functions.

As we show in the numerical simulations, the method is well-suited for the coupling of problems defined on globally non-conforming meshes or discretized with basis functions of different polynomial degree in each subdomain, as well as multiphysics (specifically, fluid-structure interaction) problems. We also investigate the possibility of coupling solutions obtained with incompatible numerical methods, namely the finite element method and isogeometric analysis.

REFERENCES

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