The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

A QUASI-NEWTON-ACCELERATED ROBIN-NEUMANN SCHEME FOR FLUID-STRUCTURE INTERACTION

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Keywords: *Partitioned Approach, Robin-Neumann Coupling, Quasi-Newton Methods*

Despite its popularity in modern fluid-structure interaction (FSI), the Dirichlet-Neumann coupling scheme is not without shortcomings: While the inherent added-mass instability has lost a lot of its impact thanks to interface quasi-Newton methods [1, 2], convincing solutions for the incompressibility dilemma [3], i.e., the breakdown of the Dirichlet-Neumann scheme for fully-enclosed incompressible fluids, are still comparatively rare.

One option is to switch over to the Robin-Neumann scheme, which extends the fluid problem by a Robin boundary condition that incorporates both structural deformation and Cauchy tractions. This coupling algorithm does in fact tackle both incompressibility dilemma and added-mass effect [4]. However, the price to be paid is a strong dependency on the Robin parameter – with very limited possibilities for good a priori choices.

In this work, we propose a strategy to combine the Robin-Neumann scheme with interface quasi-Newton methods and benefit from their mutual strengths. The performance of this new coupling algorithm is demonstrated for numerical examples (with and without pure-Dirichlet character) and compared to Dirichlet-Neumann approaches with quasi-Newton acceleration.

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