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On the accuracy of Robin–type loose coupling for FSI

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The development and the analysis of efficient loosely coupled schemes for incompressible fluid-structure interaction (FSI) has been a very active field of research during the last fifteen years. Robin-type interface coupling emerged as a way of splitting the fluid and solid time-marchings without encountering the traditional added-mass stability issues (see, e.g., [1]). This superior stability came however at a price, notably in the case of the coupling with thick-walled solids, since most of the existing Robin-type loosely coupled schemes are known to introduce a certain spatial non-uniformity in the splitting error, which make them unusable in practice. In this talk, we will revisit the Robin-type loose coupling of [1] with a Robin parameter independent of the mesh parameter and show that the resulting method overcomes the above mentioned spatial non-uniformity issues, but with only sub-optimal accuracy in time (see, e.g., [2, 3]). Finally, we will show that a nearly optimal accuracy result can actually be obtained through a specific variational treatment of the interface terms in the analysis (see [4]). The theoretical findings will be illustrated via numerical experiments in a benchmark.

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