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ON MONOLITHIC AND CHORIN-TEMAM SCHEMES FOR INCOMPRESSIBLE FLOWS IN MOVING DOMAINS.

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SUMMARY

Several time discretized domain for the incompressible Navier-Stokes equations (iNSE) in moving domains have been proposed in literature. Here, we introduce a unified formulation that combines different approaches found in literature, allowing a common well posedness and time stability analysis. It can be therefore shown that only a particular choice of numerical schemes ensure such properties under some restrictions. The analysis will be shown for Chorin-Temam schemes using the insight found in the monolithic case. Results are supported from numerical simulations and its usage in fluid-solid interaction problems will be presented.

Key words: *numerical schemes, stability analysis, incompressible flows, fluid-structure interaction*

Estimating parameters from heart contraction data, using e.g. magnetic resonance imaging [1, 2, 3, 4], requires several techniques such as the estimation algorithms, e.g. [5], fluid-solid coupling schemes modeling the physics itself e.g. [6, 7] and in particular, the discretization of fluid problem arising from the blood movement e.g. [8].

In such a context, several works have been reported dealing with numerical solutions of the iNSE in moving domains within the Arbitrary Lagrangian Eulerian formulation (ALE). Different choices of time discretization have been reported , e.g. [9], [10]. To the best of the authors knowledge, only a few monolithic schemes have been throughly analyzed, e.g. [11, 12, 13, 14] while no analysis has been reported for Chorin-Temam (CT) methods, being an alternative option when requirements such a low time computations are needed, specially for future industrial applications.

The goal of this talk is to present the finding of well-posedness and unconditional energy balance of the iNSE-ALE for several reported CT discretization schemes within a single formulation, published in [15]. It will be supplemented with an usage case for fluid-solid interaction problems.

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