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A SEMI-IMPLICIT METHOD FOR THROMBUS FORMATION IN HAEMODYNAMIC FLUID–STRUCTURE INTERACTION

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Blood clotting and thrombus formation play a key role in many cardiovascular diseases, having a drastic impact on surgical planning and options, risk factors and possible long-term treatment and surveillance. Due to vast developments in the field of computational biomechanics, modern simulation tools can significantly aid clinical decision-making, inspire identifying possible alternatives or highlight risks associated with individual interventions. However, despite these advances, computational modeling of thrombus formation has remained a challenging application, since it combines demanding fluid flow or even fluid-structure interaction problems with complex bio-chemical systems.

In this contribution, we therefore extend a split-step scheme for incompressible non-Newtonian fluid–structure interaction [1] by the thrombus formation model of Menichini et al. [2]. A semi-implicit framework allows coupling only the hyperelastic bulk solid's displacement and the fluid pressure iteratively, while the equations governing constituent transport and all other involved fields are solved merely once per timestep. Herein, first results in a clinically relevant setting are presented to highlight the efficiency and applicability of the framework.

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