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On the jump conditions for an immersed interface method

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New jump conditions for an immersed interface method (IIM) for the solution of the Navier-Stokes equations with continuous viscosity are presented. The difference between the new jump conditions and those in some of the existing IIM literature is found in those pertaining to a scalar function φ from which the fluid pressure is calculated and which satisfies a Poisson equation in the PmII projection scheme of Brown et al. In particular, it is shown that the jump terms for an intermediate velocity v^* in the first step of the projection scheme arise naturally as being those for the fluid velocity v if it is assumed that φ is twice continuously differentiable throughout the flow domain Ω. Conversely, it is proved that if all the jumps in v^* and v and their derivatives up to second order are assumed to be the same then this implies that $\varphi \in C^2(\Omega)$. Numerical experiments are performed to show that temporal and spatial orders of convergence of the derived scheme are globally of at least second order, even in the presence of an interface.

This is joint work with Mounir Bennoune and Jérôme Morin-Drouin.

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