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# Fictitious domain methods and space accuracy

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## ABSTRACT

Maintaining the optimal order of convergence is a crucial issue in the context of fictitious domains. Most approaches rely on a modification of the discrete operator that affects the structure of the corresponding matrix, thereby ruling out the straight use of fast solvers. We shall present some strategies that have been proposed to address these issues, and present in detail a Smooth Extension Method based on a modification of the right hand side, in the context of fluid particle flows. Since a source of non-optimality is the nonsmooth character of the global velocity field (with corresponds to a rigid motion inside the particles), we overcome this problem by building a smooth extension of the fluid velocity field by estimating an appropriate forcing term within the particles. We shall present how this approach makes it possible to perform direct three dimensional simulations of large collections of particles with a good accuracy, while keeping the possibility to use fast solvers.