Numerical resolution of elliptic problems in perforated domains

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Abstract

The modelling of composite materials or fluid particle flows calls for efficient solvers of Poisson-like problems on domains with (possibly many) holes or inclusions. After a description of the native difficulties of the problem, we will give an overview of the several methods which have been proposed to address this challenge, and present in detail some of them, paying a special attention to numerical efficiency and conditionning aspects. Among the methods we plan to present, let us mention the direct approach, based on a boundary-fitted (and therefore unstructured) mesh, and fictitious domain methods (based on a global mesh which covers the whole region of interest), like the Penalty Method, the Fat Boundary method, and some new variants of the Saddle Point approach à la Glowinski.