UPSCALING METHOD FOR PROBLEMS IN PERFORATED DOMAINS WITH NON-HOMOGENEOUS BOUNDARY CONDITIONS ON PERFORATIONS USING NONLOCAL MULTICONTINUUM METHOD

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In this work, we present an upscaling method for problems in perforated domains with non-homogeneous boundary conditions on perforations. Our methodology is based on the recently developed Nonlocal multicontinuum method (NLMC). The main ingredient of the method is the construction of suitable local basis functions with the capability of capturing multiscale features and non-local effects. We construct multiscale basis functions for the coarse regions and additional multiscale basis functions for perforations, with the aim of handling non-homogeneous boundary conditions on perforations. We start with describing our method for the Laplace equation, and then extending the framework for the elasticity problem and parabolic equations. The resulting upscaled model has minimal size and the solution has physical meaning on the coarse grid. We will present numerical results (1) for steady and unsteady problems, (2) for Laplace and Elastic operators, and (3) for Neumann and Robin non-homogeneous boundary conditions on perforations. Numerical results show that the proposed method can provide good accuracy and provide significant reduction on the degrees of freedoms.