Numerical simulation of the transport and flow problems in perforated domains using Multiscale model reduction

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Abstract. Many processes in real applications have multiscale nature. These include flow and transport in porous media, deformation in composite materials, filtration processes and so on. In these physical processes, the transport of the material can be described by the convection-diffusion equation. We use mixed formulation for the transport equation. The convection term in the transport equation is governed by a flow velocity field. The flow can be described by Darcy equaiton or the steady-state Stokes equation. Numerical solutions for flow and transport equations are expensive and require resolving fine-scale details. For this reason, some type of model reduction is necessary. In this work, we consider transport and flow processes in perforated domains. For coarse grid approximation, we use Generalized Multiscale Finite Element method (GMsFEM) and construct local multiscale basis functions. We present numerical results for model problem in two dimensional perforated domain.