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Generalized multiscale discontinuous Galerkin method for solving the heat problem with phase change[☆]

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Abstract

In this work, we consider a numerical solution of a heat transfer problem with phase change in heterogeneous domains. For simulation of heat transfer processes with phase transitions, we use a classic Stefan model. Computational implementation is based on generalized multiscale discontinuous Galerkin method (GMsDGM). In this method the interior penalty discontinuous Galerkin method is used for the global coupling on a coarse grid. The main idea of these methods is to construct a small dimensional local solution space that can provide an efficient calculation on coarse grid level. We present numerical results for different geometries to demonstrate an accuracy of the method.

Keywords:
Multiscale method, Discontinuous Galerkin, GMsDGM, GMsFEM, IPDG, heat transfer, heterogeneous media, Stefan problem.

Introduction

Nowadays study of applied problems is based on wide application of computing tools through using mathematical models and modern computing algorithms. Mathematical modeling is used to predict permafrost thermal effects. In permafrost soil modeling is necessary to take into account the following significant features: dynamic lithological composition and this thermal-physical properties, abrupt changing of soil thickness and geological structure, azonal conditions and localized thaw zones, various ice-rich

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