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Multiscale model reduction of artificial ground freezing

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Research in geotechnical applications of artificial ground freezing is important task in maintaining the stability of engineering structures in permafrost. Safe design require a correct prediction of the coupled thermo-mechanical behavior of soils. Mathematical model of process of thermal stabilization (artificial freezing) on the classical Stefan model is built.

A feature of the modeling of this problems under consideration is the clearly expressed geometric diversity of the objects being modeled: the small dimensions of the freezing devises and the large dimensions of the modeling domain. Thus, this problems computation may be very expensive. In this regard, to improve the efficiency of calculations, the need arises to develop new computational algorithms. A coarse-scale solver based on Generalized Multiscale Finite Element Method are constructed. The main idea of which method is to construct a small dimensional local solution space that can be used to efficient solution on coarse grid.

We present numerical results of numerical simulation problem in perforated domains in two-dimensional and three-dimensional formulations are presented.

References

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References

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