

MASTER'S THESIS

Adaptive moving grid method to two-phase flow problems

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Adaptive Moving Grid Method to Two-phase Flow Problems

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Abstract

This thesis is concerned with the numerical simulations on two-phase flow models. The numerical schemes combine the mixed finite element (MFE) method and finite volume (FV) method, which are employed to simulate two-phase flows in homogeneous or heterogeneous media. We use moving mesh method that distributes more grid points near the sharp interfaces.

The models of two-phase flows have been widely used in various fields, such as power generation, chemical and petroleum exploitation. Flows of such type are important for the design of steam generators, internal combustion engines, jet engines, refrigeration systems, pipelines for transport of gas and oil mixtures, etc.

The most important characteristic of two-phase flow is the existence of interfaces, which separates the phases and the associated discontinuities across the phase interfaces, and also separates different media in heterogeneous media cases. The main challenge lies in that extremely fine meshes are required over thin interfaces of the physical domain in order to produce physically correct results. To distribute more grid points in the interfaces, in this thesis we extend the moving mesh method based on harmonic mapping to increase the numerical efficiency.

The moving mesh method is applied according to the shape of saturation. Several one and two dimensional numerical experiments are carried out to show the effectiveness of the proposed scheme.

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