The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

Shifted Boundary Method and Moving Front for Mixed Formulation of Phase Change Problems

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Keywords: *Shifted boundary method, Reconstruction Procedure, Moving front, Mixed formulation, Finite element method, Stefan problem*

From a numerical point of view, the simulation of a moving boundary is challenging. In this talk, we solve a Stefan problem, representing a phase change between ice and liquid water, and we focus on the motion of the melting front. Among all the possible methods available to describe its displacement, we decide to consider the mixed formulation of the problem, where the front is described explicitly, and coupled with the shifted boundary method [1]. In this direction, the physical interface is replaced by a numerical interface called surrogate. Simulations are performed on unstructured meshes refined around the initial interface location. The displacement of the interface requires reconstruction procedures to compute the jump conditions, and the temperature and gradient values on the side opposite to the front displacement. In order to obtain an accurate prediction of the temperature field on both sides of the discontinuity, as well as the position of the discontinuity itself, we use an enhanced variant of the shifted boundary method based on an enriched stabilized mixed form [2]. The mixed formulation is chosen to provide precision on the flux used to improve the accuracy of the temperature field [3]. Numerical results will show the impact of the chosen reconstruction and the problems encountered to move the interface.

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