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Adjoint-based shape optimization of fin geometry for enhanced solid/liquid phase-change process KENICHI MORIMOTO, YUJI SUZUKI, The University of Tokyo — In recent years, the control of heat transfer processes, which play a critical role in various engineering devices/systems, has gained renewed attention. The present study aims to establish an adjoint-based shape optimization method for high-performance heat transfer processes involving phase-change phenomena. A possible example includes the application to the thermal management technique using phase-change material. Adjoint-based shape optimization scheme is useful to optimal shape design and optimal control of systems, for which the base function of the solution is unknown and the solution includes an infinite number of degrees of freedom. Here we formulate the shape-optimization scheme based on adjoint heat conduction analyses, focusing on the shape optimization of fin geometry. In the computation of the developed scheme, a meshless local Petrov-Galerkin (MLPG) method that is suited for dealing with complex boundary geometry is employed, and the enthalpy method is adopted for analyzing the motion of the phase-change interface. We examine in detail the effect of the initial geometry and the node distribution in the MLPG analysis upon the final solution of the shape optimization. Also, we present a new strategy for the computation using bubble mesh.

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