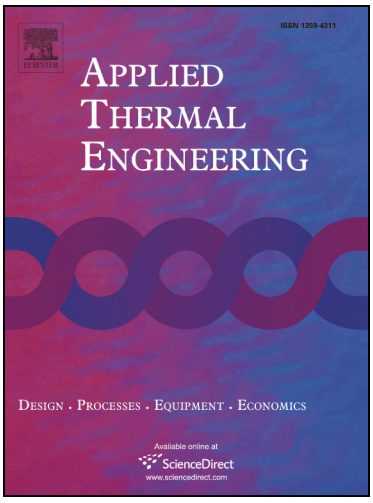

Research Paper

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Melting of a phase change material in presence of natural convection and radiation: A simplified Model

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Abstract

In this article, a simplified model for melting of a phase change material (PCM) in presence of natural convection and radiation is presented. A modified enthalpy method is adopted to solve the phase change problem, the natural convection occurring in the liquid PCM is accounted for using the enhanced thermal conductivity approach coupled with the scaling theory, and the absorbed shortwave radiation flux is added into the energy equation as a source term using a simplified solution algorithm. Two dimensional implicit finite volume method is used to solve the energy equation. First, the simplified model for melting with natural convection is validated using a CFD model, in addition to experimental and numerical benchmark solutions for a test case. Then, the simplified model for melting with combined natural convection and radiation is applied to the melting of a fatty acid eutectic filled in glass bricks, which will be used later to model the annual thermal behavior of a special translucent façade. This complete model is validated against the lattice Boltzmann-discrete ordinate method LBM-DOM. It was shown that (1) the proposed simplified model is