A Phase Change Problem including Space-Dependent Latent Heat and Periodic Heat Flux

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Abstract: In this paper, a mathematical model related to a problem of phase-change process with periodic surface heat flux and space-dependent latent heat is considered. We have used the homotopy analysis approach to acquire the solution to the problem. To show the correctness of the calculated result, the comparisons have been discussed with the existing exact solution in a particular case. The effect of various parameters on the movement of the interface is also investigated.

Keywords: *homotopy analysis method; variable latent heat; periodic boundary condition; phase change problem.*

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1 Introduction

In recent years, the phase change problem (the Stefan problem) involving diffusion process and variable latent heat is of great interest from mathematical and physical points of views. The research related to the diffusion process and its occurence can be found in many works [1–3]. Physically, a variable latent heat term arises in the Stefan problem governing the processes of movement of a shoreline in a sedimentary ocean basin due to changes in various parameters [4]. Some solutions of the Stefan problems including space-dependent latent heat have been reported in [5–7]. Zhou et al. [8] presented a phase change model (the Stefan problem) that contains a variable latent heat term and they discussed the similarity solution to the problem. After that Zhou and Xia [9] used the Kummer functions to present the similarity solution to a Stefan problem containing a more general variable latent heat term. Mathematically, the Stefan problem with periodic

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