Convection of Polymerization Front with Solid Product under Quasi-Periodic Gravitational Modulation

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Abstract: The effect of quasi-periodic gravitational modulation on the convective instability of polymerization front with solid product is studied in this paper. The model we consider includes the heat equation, the concentration equation and the Navier-Stokes equations under the Boussinesq approximation. The linear stability analysis of the problem is carried out and the interface problem is established applying the narrow zone method and the matched asymptotic expansions. The convective instability threshold is determined using numerical simulation. It was shown that the frequencies ratio has a significant effect on the convective stability domain. In particular, the stability domain changes and undergoes a shift as the frequencies ratio of the quasi-periodic modulation varies.

Keywords: *convective instability; frontal polymerization; quasi-periodic modulation.*

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1 Introduction

Frontal polymerization phenomenon is the process of converting monomer to polymer via a narrow located zone, called reaction front [1]. The influence of periodic gravitational modulation on the convective instability of polymerization reaction front with solid product was studied in [2] and it was shown that the reaction front gains stability for increasing values of the modulation frequency. In this paper, we investigate the influence of quasi-periodic (QP) gravitational modulation on the convective instability of polymerization front with solid product. Such a QP modulation may result, for instance, from the existence of two simultaneous vibrations consisting of a basic vibration with

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