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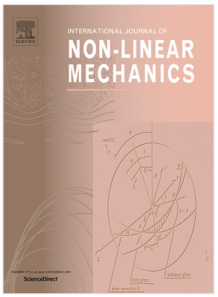

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Vinod K. Gupta, Anand Kumar, A.K. Singh

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Analytical Study of Weakly Nonlinear Mass Transfer in Rotating Fluid layer under Time-periodic Concentration/ Gravity Modulation

Vinod K. Gupta[1], Anand Kumar [2], A. K. Singh[3]
[1] Department of Mathematics, DIT University, Dehradun, India,
[2] Department of Mathematics, Central University of Rajasthan, Ajmer, India,
[3] Department of Mathematics, Institute of Science, B. H.U., Varanasi, India.
Emails: [1] vinodguptabhu@gmail.com , [2]aanandbhu@gmail.com
[3] ashok@bhu.ac.in

Abstract

The article deals with a weakly nonlinear stability analysis in rotating fluid subjected to time-periodic concentration/gravity modulation. Navier-Stoke's momentum equation with Coriolis term has been used to describe the flow. The system is considered rotating about $z-$ axis with uniform angular velocity. We consider three types of imposed time-periodic boundary concentration(ITBC). The effect of time dependent sinusoidal gravitational acceleration i.e. imposed time-periodic gravity modulation (ITGM) is also studied in this problem. In the case of ITBC, the concentration gradient between the plates of the fluid layer consists of a steady part and a time-dependent periodic part. The concentration of both plates is modulated in this case. In the problem involving ITGM, the gravity field has two parts: a constant part and an externally imposed time-periodic part. The Ginzburg-Landau amplitude equation is obtained by using power series expansion in terms of the amplitude of modulation, which is assumed to be small. The individual effects of concentration and gravity modulation on mass transports have been investigated in terms of Sherwood number. Further, the effects of various parameters on mass transports have been analyzed and depicted graphically. It is found that the effect of increasing Taylor number is decreases the value of Sherwood number. Effect of Schmidt number and various parameters occurring in the system on mass transfer is also discussed. Further, it is found that the mass transport can be controlled by suitably adjusting the frequency and amplitude of the modulation.
Keywords: Concentration modulation, Gravity modulation, weakly nonlinear stability analysis, Ginzburg-Landau

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