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Abstract

The aim of this paper is to study the influence of quasi-periodic gravitational modulation on convective instability of reaction fronts in porous media. The model contains reaction diffusion equations coupled with the hydrodynamic equations under the Darcy-Boussinesq approximation. The direct numerical simulation of the dimensionless problem is fulfilled using the alternative direction method and the fast Fourier transform method. The convective instability boundary is found depending on the Lewis number and the amplitude of vibration.

References

- Aronson, D. , Weinberger, H. , 1975. Nonlinear Diffusion in Population Genetics, Combustion and Nerve Propagation; Lecture Note in Math Vol, 446, pringer-Verlag, Berlin, 1975.
- Brunet, E. , Derrida, B. , 1997. Shift in the velocity of a front due to a cutoff, Phys. Rev. E 56 (1997), 2597–2604.
- Rogers, J. L. , Schatz, M. F. , Bougie, J. L. , Swift, J. B. , 2000. Rayleigh-Bnard convection in a vertically oscillated fluid layer, Phys. Rev. Lett. 84 (2000), no. 1, 87–90.

- Murray, J. D. , 1989. Mathematical Biology, Springer-Verlag, Berlin.
- Volpert, V. , Petrovskii, S. , 2009. Reaction-diffusion waves in biology, Physics of Life Reviews, 6 (2009), 267–310.
- Volpert, A. , Volpert, Vit, Volpert, Vl. ,1994. Traveling wave solutions of parabolic system, American Mathematical Society, Providence, RI, (1994) 448 pp.
- Freidlin, M. , Markov, 1996. Processes and Differential Equations: Asymptotic Problems, Birkhauser, Basel.
- Garbey, M. , Taik, A. , Volpert V. , 1998. Influence of naturel convection on stability of reaction fronts in liquids, Quart Appl Math 1998; 53,135.
- Allali, K. , Ducrot, A. , Taik, A. , Volpert, V. , 2007. Convective instability of reaction fronts in porous media, Math. Model. Nat. Phenom. 2 (2007), no. 2, 20–39.
- Aatif, H. , Allali, K. , El Karouni, K. , 2010. Influence of Vibrations on Convective Instability, Math. Model. Nat. Phenom. Vol. 5, No. 5, (2010) 123-137.
- Boulal, T. , Aniss, S. , Belhaq, M. , Rand, R. , 2007. Effect of quasiperiodic gravitational modulation on the stability of a heated fluid layer, Phys. Rev. E. 52 (2007), 76, 56320.
- Boulal, T. , Aniss, S. , Belhaq, M. , Azouan, A. , 2008. Effect of quasi-periodic gravitational modulation on the convective instability in Hele-Shaw cell. International Journal of Non-Linear Mechanics 2008; 43:852–7.
- Boulal, T. , Aniss, A. , Belhaq, M. , 2008. Quasiperiodic gravitational modulation of convection in magneticfluid, Thermal Non-Equilibrium, Lecture Notes of the 8th International meeting of thermodiffusion, 9-13 June, 2008, Bonn, Germany, edited by S. Wiegand, W. K¨ohler, J. K. G, Dhont (2008), (300) pages ISBN: 978-3-89336-523-4.
- Allali, K. , Belhaq, M. , El Karouni, K. , 2012. Influence of quasi-periodic gravitational modulation on convective instability of reaction fronts in porous media, Commun Nolinear Sci Numer Simulat 17(2012)1588–1596.

Index Terms

Computer Science   Applied Sciences

Keywords

Direct numerical simulation   quasi-vibration   porous medium   reaction front