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A theoretical and experimental study on the unidirectional motion of a camphor disk.
(English) Zbl 1076.76608
Physica D 194, No. 3-4, 151-165 (2004).

Summary: The self-sustaining motion of a camphor disk in an annular water channel was investigated. Unidirectional motion along the water channel is maintained after a local perturbation is applied to the system. Introduction of a partition into the channel changes the unidirectional motion into back-and-forth motion. To clarify the nature of the driving force that moves the settling camphor disk, the dependence of the velocity of the disk on the viscosity of the aqueous phase was measured. The experimental results are discussed in relation to the distribution of the camphor layer around the disk as the driving force. The nature of the self-motion is qualitatively reproduced by numerical computations using a mathematical model that incorporates the distribution of the camphor layer around the disk and the viscosity of the aqueous phase. Furthermore, the existence and stability of the unidirectional motion of the camphor disk depending on the viscosity of the aqueous phase are analyzed numerically.

MSC:

76U05 General theory of rotating fluids
76R50 Diffusion
76-05 Experimental work for problems pertaining to fluid mechanics

Keywords:

reaction-diffusion model; Bifurcation; Traveling pulse

Full Text: DOI

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