Collective Motion of Camphor Boats – Reduction from Reaction-Diffusion Systems –

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The collective motion of camphor boats in the water channel exhibits both a homogeneous and an inhomogeneous state, depending on the number of boats, when unidirectional motion along an annular water channel can be observed even with only one camphor boat [4]. In a theoretical research, the unidirectional motion is represented by a traveling wave solution in a model [3]. Since the experimental results described above are thought of as a kind of bifurcation phenomena, we would like to investigate a linearized eigenvalue problem in order to prove the destabilization of a traveling wave solution. However, the eigenvalue problem is too difficult to analyze even if the number of camphor boats is 2. Hence we need to make a reduction on the model. Based on the argument in [2], we apply the center manifold theory and reduce the model to an ordinary differential system, in which the uniform flow is destabilized by the increase of the density of particles via Hopf bifurcation and a fundamental diagram as reported in [1] can be generated.

This is a joint work with Ei Shin-Ichiro, Nagayama Masaharu in Hokkaido University, and Tomoeda Akiyasu in Musashino University.

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Acknowledgement The author is supported by the Grant-in-Aid for Young Scientists (B) 24740071.