



Pattern Formations and Oscillatory Phenomena: 3. Dynamics of Droplets

Hiroyuki Kitahata, Natsuhiko Yoshinaga, Ken H. Nagai, Yutaka Sumino

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In this chapter, we consider the motion of a droplet and the surrounding flow accompanied by the motion. Our specific attention is on the spontaneous and autonomous motion of a droplet. Such a system has no applied external force and no asymmetry imposed a priori. Nevertheless, the droplet moves by consuming energy and by breaking the symmetry of the system. The phenomenon reminds us of biological systems that can also move spontaneously. These systems, which are called self-propulsive systems, have recently been extensively studied after several model experiments were proposed using chemical reactions. The mechanism of such motion is less clear, though theoretical and computational studies have revealed several novel aspects of the motion in contrast with the motion under a given asymmetry. We discuss recently developed experimental systems. Then, we focus on a suspended droplet that swims, and explain how the result can be analyzed in terms of hydrodynamics by using the concept of surface tension. Finally, we apply the method to the analysis of a swimming suspended droplet induced propelled by a chemical pattern generated inside the droplet.

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