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The dynamics of a deflated giant Vesicle in a simple shear flow
TAKESHI YAMADA, SHU TAKAGI, YOICHIRO MATSUMOTO, Dept. of Mechanical Engineering, The University of Tokyo — Giant vesicle (GV) is an artificial capsule which is composed of lipid bilayer and which has the size of several tens microns. In the present study, 3-D numerical simulation for the dynamics of a GV in a simple shear flow was conducted. Immersed-Boundary method was used to simulate a deformation of GV. We expressed a GV model with the fluidity of membrane taken into account and with its volume and surface area kept constant. At first, we calculated the deflated GV as an equilibrium shape. And a long stick-like shape called a prolate shape was obtained. Then we investigated the dynamics of a prolate GV in a simple shear flow for various values of viscosity inside the GV (μ_{in}) and swelling ratio, Sw. Sw denotes the degree of deflation of a GV. Depending on μ_{in}, GV showed two kinds of motions. When μ_{in} is not large enough, a GV settled down a steady shape with its major axis at a certain angle θ. This motion is called tank-treading motion. We investigated the angle θ for various values of Sw. And our results are in good agreement with the results by Kraus (1996). Then we investigated the relationship between the angle θ and μ_{in}. As the value of μ_{in} becomes larger, the angle θ becomes smaller. When μ_{in} exceeded the threshold value, a GV started tumbling its major axis in clockwise direction. The transition between a prolate shape and a disc shape was observed during tumbling motion.

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