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Numerical analysis of a stable waltzing pair of Volvox TAKUJI ISHIKAWA, Tohoku University, KNUT DRESCHER, KYRIACOS LEPTOS, TIMOTHY J. PEDLEY, RAYMOND E. GOLDSTEIN, University of Cambridge —
When we placed suspensions of Volvox in glass-topped chambers, we observed the frequent formation of stable bound state of two colonies orbiting each other, referred to as a waltzing motion. In this study, we computationally investigate the mechanism of the waltzing motion. In modelling a Volvox computationally, we assumed that a Volvox was a rigid sphere generating force distribution slightly above the surface. The flow field around a Volvox was assumed to be Stokesian, and sedimentation and bottom-heaviness were taken into account. Equation for the flow field was solved by a boundary element method by coupling with the force-torque conditions of the cell bodies. If we initially place two Volvox blow the wall, they first swim towards the wall and show steady hovering motion adjacent to the wall. Then, they tend to attract each other gradually until they come to close contact. Finally, they show stable waltzing motion with steady rotational velocities, in a similar manner with the experimental observations. We conclude that the wall boundary, the bottom-heaviness and the swirl velocity are necessary in reproducing the waltzing motion.

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