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Hydrodynamic interaction of two unsteady squirmers TAKUJI ISHIKAWA, DAVIDE GIACCHE, Tohoku University — The study of pair-wise interactions between swimming microorganisms is fundamental to the understanding of the rheological and transport properties of semi-dilute suspensions. In this study, the hydrodynamic interaction of two ciliated microorganisms is investigated numerically using a boundary-element method. The microorganisms are modeled as spherical squirmers that swim by time-dependent surface deformations. The results show that the inclusion of the unsteady terms in the ciliary propulsion model has a large impact on the trajectories of the interacting cells, and causes a significant change in scattering angles with potential important consequences on the diffusion properties of semi- dilute suspensions. Furthermore, the analysis of the shear stress acting on the surface of the microorganisms revealed that the duration and the intensity of the near-field interaction are significantly modified by the presence of unsteadiness. This observation may account for the hydrodynamic nature of randomness in some biological reactions, and supersedes the distinction between intrinsic randomness and hydrodynamic interactions, adding a further element to the understanding and modeling of interacting microorganisms.

Takuji Ishikawa
Tohoku University

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