Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Collision of two deformable torque swimmers HITOMU MATSUI, TOSHIHIRO OMORI, TAKUJI ISHIKAWA, Dept. Finemechanics, Tohoku University — Understanding the property of a micro-organism suspension is important in bio-engineering. When the suspension is non-dilute, micro-organism interacts with each other and these interactions are governed by the hydrodynamical and biological features. Former studies focusing on cell-cell interaction have unveiled the hydrodynamical effect, however, contribution of cell's deforming during the interaction is still unknown. Moreover, biological reaction, for example avoiding and escape reactions of a ciliate, may affect the suspension property. These biological reactions are considered to be initiated by mechanical stimuli imposing over cell membrane. Thus, analyzing membrane tension should help to understand the mechanism of ciliate biological responses. In this study, to investigate the contribution of deformation and membrane condition while two swimmers interact, we numerically simulate cell-cell interaction by applying a deformable ciliate model. We modeled a ciliate body as a deformable capsule and thrust forces generated by the ciliary beat as torque distribution. Owing to the tiny cell size of ciliate, fluid is regarded as Stokes flow. We computed a variety of collisions with different geometry and cell's deformability, and then analyzed the trajectory and membrane tension. We found deformability affects the trajectory and clarified membrane tensions differ among the geometries. These results allow us to discuss the sensing ability of ciliate in the suspension.

Hitomu Matsui
Dept. Finemechanics, Tohoku University

Date submitted: 25 Jul 2019 Electronic form version 1.4