Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Shear-Induced Lift Force Acting on a Bubble in Surfactant Solutions MASATO FUKUTA, SHU TAKAGI, YOICHIRO MATSUMOTO, Dept. of Mech. Eng., The University of Tokyo — In surfactant solutions, surfactant molecules adsorb to the gas-water interface, and the boundary condition on the bubble surface changes. This change affects the flow around a bubble and its motion. For example, it is well known that the rising velocity of bubble in a contaminated water decreases significantly compared with that in super-purified water. This phenomenon is explained by the Marangoni effect, and has been investigated experimentally and numerically. Many of previous studies about the effect of surfactant on the bubble motion assumed to be axisymmetric, and to our knowledge, there are few reports about the effects of surfactant on the three-dimensional motion of bubble. In this study, the lift force acting on a spherical bubble is investigated by solving the three-dimensional Navier-Stokes equations with considering the ad/desorption of surfactant. To evaluate the change of the boundary condition and the force acting on a bubble with high accuracy, the boundary-fitted grid is adopted and the governing equations are solved in an orthogonal curvilinear coordinate system. From the results of our calculation, we discuss the influence of the surfactant characteristics related to the ad/desorption kinetics and that of the concentration of surfactant on the lift force.

Masato Fukuta
Dept. of Mech. Eng., The University of Tokyo

Date submitted: 05 Aug 2005 Electronic form version 1.4