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The momentum balance in upward turbulent channel flow laden with microbubbles[1] YOICHI MITO, SHOTA IKEDA, Kitami Institute of Technology — The influence of the addition of microbubbles as dispersed gas phase on fully-developed turbulent flow in a vertical channel in which the liquid is flowing upward with a constant pressure gradient or a constant rate has been examined by using direct numerical simulation to calculate the liquid velocities seen by the microbubbles and the point force method to consider the influence of the microbubbles on the liquid. The microbubbles are represented by solid spheres and are released from uniformly distributed point sources. The streamwise momentum balance shows that the influence of the addition of the microbubbles on the drag of the liquid flow appears as a function of volume fraction, Froude number and friction velocity that results from distribution of the microbubbles. The experimental conditions are chosen such that zero to two hundred percent of the pressure gradient of the single-phase flow is added by the addition of the microbubbles. The drag decreases by the addition of the microbubbles, whereas the frictional drag increases with the increases in the accumulation of the microbubbles on walls, which attenuates the effect of reducing drag. Changes in the liquid turbulence are not clearly seen except for what are due to the changes in the bulk Reynolds number.

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