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Inertial migration of spherical particles in square channel flows

KAZUMA MIURA, Kansai University Graduate School, TOMOAKI ITANO, MASAKO SUGIHARA-SEKI, Kansai University — It has been known that particles suspended in the laminar pipe flow migrate laterally toward a certain radial position due to the inertial effect. In this research, we investigated experimentally the inertial migration of neutrally buoyant spherical particles in square channel flows in the range of Reynolds numbers (Re) from 100 to 1200. The measurement of the particle positions at several cross-sections revealed that there are eight equilibrium positions of the particles in the cross-section, four of them located near the centers of the channel faces and the other four located near the channel corners. The corner equilibrium positions were found to exist only for Re larger than about 260. It was also shown that an increase in Re shifts the channel face equilibrium positions toward the channel center, whereas it shifts the corner equilibrium positions toward the channel corner. As the observation sites become downstream, the particles are more focused near the equilibrium positions. The distribution of the particles measured in a short distance from the channel inlet indicated that the lateral forces exerted on the particles located near the centers of the channel faces would be larger compared to the particles at the other positions in the cross-sections.

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