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Lateral migration of a spherical particle in square channel flows¹ MASAKO SUGIHARA-SEKI, NAOTO NAKAGAWA, ATSUSHI KASE, RYOKO OTOMO, Kansai University, MASATO MAKINO, Yamagata University, TO-MOAKI ITANO, Kansai University — Particles suspended in the Poiseuille flow through circular cylindrical tubes have been known to migrate perpendicular to the flow direction due to the inertial effect and to be focused toward an equilibrium radial position. Recently, the distributions of neutrally buoyant spherical particles were measured in square channel flows and it was reported that there are eight equilibrium positions of the particles in the channel cross-section, located near the centers of the channel faces and near the channel corners (Miura et al. JFM 749, 320-330, 2014). The present study is aimed to simulate numerically the motion of a spherical particle suspended in square channel flows for the channel Reynolds number (Re) up to 1000. The computation of lateral forces exerted on the particle indicated the presence of equilibrium positions at the center of the channel faces and at the channel corners. The channel corner equilibrium positions were found to be unstable for low Re, whereas the channel face equilibrium positions are always stable. As Re increases, the channel corner equilibrium positions are shifted toward the channel corner, while the channel face equilibrium positions are shifted toward the channel center. These results account for the experimental measurements.

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