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Inertial focusing patterns and their transition for a neutrally buoyant sphere suspended in rectangular duct flow HIROSHI YAMASHITA, MASAKO SUGIHARA-SEKI, Kansai University — Spheres suspended in rectangular duct flow are known to cross streamlines due to the inertial lift force and focus at certain points in the downstream cross-section. Recent studies have shown the appearance of various focusing points, depending on the aspect ratio of the cross-section (A), the blockage ratio of the sphere to the duct (β), and the Reynolds number (Re). Representative focusing patterns for spherical particles in rectangular duct flow are that the particles focus only near the center of the long side (pattern (a)) and near both the centers of its short and long sides (pattern (b)). In this study, we have aimed at elucidating the focusing patterns and their transition appeared in suspension flow through rectangular ducts, by a numerical simulation. We calculated the map of the inertial lift force over the cross-section and estimated the focusing positions and the particle trajectories. We have found that, for A =2 and β =$\sim$0.3, an increase in Re from 100 to 300 induced the transition of the focusing pattern from (a) to (b). By capturing changes of the nullclines for the particle trajectories, we explained this transition as the bifurcation phenomena in terms of the particle equilibrium positions.

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