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Flow induced oscillation of a cylinder in a Hele-Shaw cell B. SEMIN, H. AURADOU, J.-P. HULIN, FAST Laboratory, CNRS, Pierre et Marie-Curie Paris 6 and Paris-Sud 11 Universities (France), A. DECOENE, V. SCELLES, Orsay Maths Department, CNRS, Paris-Sud 11 University (France), A. LEFEBVRE, CMAP, CNRS, Ecole Polytechnique (France) — Spontaneous regular oscillations of a confined cylinder in a steady Poiseuille flow are observed down to small Reynolds numbers ($Re = 15$). In this study, the cylinder is perpendicular to the mean flow, parallel to the walls of a Hele-Shaw cell and free to move only in the direction perpendicular to them; the ratio of the diameter of the cylinder by the cell aperture is 0.7. Experimentally, the cylinder is held by long thin threads. This flow-structure coupling, resulting from the confinement, has also been modelled successfully using $2D$ finite elements simulations. The oscillations are quasi-sinusoidal in a wide range of Re value (Re is defined using the mean velocity and the diameter of the cylinder). The threshold value ($Re = 15$) is much smaller than for classical vortex shedding past a nonconfined cylinder ($Re = 45$). The amplitude increases with the Reynolds number until saturation. The frequency increases almost linearly with Re (Strouhal number close to 1) even when contact with the walls occurs; it increases with the diameter of the cylinder and decreases with its density.

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