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Computational optimization of inertial focusing microfluidics utilizing immersed boundary methods PATRICK GIOLANDO, School of Mechanical Engineering, Purdue University, TAMARA KINZER-URSEM, Weldon School of Biomedical Engineering, Purdue University, STEVE WERELEY, School of Mechanical Engineering, Purdue University — Inertial focusing microchips have gained momentum in the past decade for size separation of particles and cells. Unlike many other techniques for size separation, inertial focusing is simple and passive allowing for greater applicability for point-of-care systems. One such chip design relies on an expanded channel to produce microvortices to capture and retain particles within a size range. Although these chips show promise for an elegant solution there are numerous parameters impacting the efficiency of the chip that require optimization including particle structure, flow conditions, cavity geometries, and particle concentration. Immersed boundary methods are implemented to model not only the complex geometry of the chip, but also allows for the forces on the particle to be resolved by integrating the total stress tensor over the surface of the particle as well as the impact of particles on the flow. Our simulations determined the optimal cavity geometry, as well as the relationship between the Reynolds number and the size of particles captured. With the two-way coupling of the fluid-structure interface considered we gained insight into the impact of concentration on particle capture.

Patrick Giolando
School of Mechanical Engineering, Purdue University

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