

Feedback control system simulator for the control of biological cells in microfluidic cross slots and integrated microfluidic systems

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Electronic Supplementary Information – Explanatory Notes

Figure S1: Experimental Validation of Computational Fluid Dynamics simulations of the microfluidic cross slot.

Velocity vectors, derived from particle image velocimetry (PIV) measurement of a saddle point flow in a scale model is shown overlaid with contours from CFD modelling of the same geometry. a) PIV and CFD results for a saddle point position centred in the channel; and b) shows the results for a saddle point position shifted 20 μ m from the centre point in the y direction.

Movies: Simulation Movies for cases I-III

Keywords: fluid dynamics simulation, control systems, saddle point flows, biological cell trapping and manipulation, microfluidics

Simulation of a cell being captured in a saddle point flow. Active PID control is used to capture and maintain the position of a simulated red blood cell in the centre of the channel.

- Case I: Idealised control with no external sources of noise.
- Case II: Less ideal control system, with moderate observer resolution and fluid response time.
- Case III: Noisy control system, slow fluid response time, low observer resolution.

Detailed information about the three cases is available in the article text.