Lateral migration of a droplet by optical force in a uniform flow
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— The lateral migration of a droplet under an optical force in a uniform
flow was studied to show the separation characteristics in the cross-type optical
separator. The initially spherical droplet was moved through the fluid flow using
a loosely-focused Gaussian laser beam along the direction normal to the flow. To
simulate such a system, the lattice Boltzmann method was adopted to obtain the
two-phase flow field, and the dynamic ray tracing method was applied to the optical
force calculation. The optical forces acting on the spherical droplets are found to
be in good agreement with the theoretically predicted values. The trajectories of
the droplets are obtained and compared with the experimental data. Simulations
on various flow and optical parameters have been made. It is found that the lattice
Boltzmann method, combined with the dynamic ray tracing, can be utilized to design
optical manipulation systems.

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