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Analytical solution of microbes interacting with surfaces

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ABSTRACT

Nowadays, there is a rising interest in studying the behavior of microbes and their interactions with flow and surfaces. In order to explore the velocity field, pressure and forces around the microbes, the solution of Stokes equations, which is called a Stokeslet, is used. This solution represents a singular velocity field due to a concentrated external force acting on fluid at a single point. This singularity could cause the expression of velocity not integrable. We use the Regularized Stokeslet Method and Method of Images to deal with this problem. The expression of force is replaced by a radially symmetric function, which distributes the force on a certain area rather than at a single point. We perform different numerical simulations to validate the code against analytical solution for flow around a sphere and a swimmer. The numerical results match well with the exact solutions. It can be concluded that the analytical solutions of microbes interacting with surfaces can be well simulated using the method of Regularized Stokeslet.

KEYWORDS

Microbes, Surfaces, Regularized Stokeslet, Method of Images