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A Numerical Analysis of a Capsule Containing Multiple Small Capsules in Simple Shear Flow

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A capsule is a particle consisting of a deformable membrane and inner fluid, and used as a model of a red blood cell (RBC). When a malaria parasite infects a RBC, the parasite grows and finally divides into a few dozens of parasites within the host RBC. In this study, we investigate the effect of parasites on the behavior of the RBC. An infected RBC is modeled by a capsule containing multiple small capsules. We simulate the behavior of the capsule in simple shear flow by using a numerical method coupling the boundary element method of fluid mechanics with the finite element method of membrane mechanics [1]. A drawback of this method is a heavy computational load. To accelerate the computation, all the processes are fully implemented in graphics processing unit (GPU) computing.

Keywords: Fluid-membrane interaction, Boundary element method, Finite element method, Malaria, GPGPU

1. Walter, J., Salsac, A.-V., Barthes-Biesel, D. and Tallec P. L., 2010, "Coupling of finite element and boundary integral method for a capsule in a Stokes flow", Int. J. Numer. Meth. Eng., 83, pp. 829-850.