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76th Annual Meeting of the Division of Fluid Dynamics

Sunday–Tuesday, November 19–21, 2023; Washington, DC

Session ZC34: Micro/Nano scale Flows: Particles

12:50 PM–3:00 PM, Tuesday, November 21, 2023

Room: 201

Chair: William Uspal, University of Hawai'i at Manoa

Abstract: ZC34.00006 : Attracting modes of sedimentation for highly elastic fibers settling under gravity in a viscous fluid*

1:55 PM–2:08 PM

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The sedimentation of highly elastic fibers under gravity in a viscous fluid is investigated numerically. The fiber is represented by an almost inextensible bead-spring chain with a small bending stiffness. The fiber's flexibility is described by a dimensionless elasto-gravitation number B which relates hydrodynamic forces acting on the fiber and the fiber's bending stiffness. Sedimentation dynamics are obtained employing the *Hydromultipole* numerical codes to solve the Stokes equations via a very accurate multipole method. The evolution of the fiber is monitored over a relatively long time. In addition to the fixed shape modes previously identified and discussed in the literature, we find attracting sedimentation modes with periodically changing shapes. A brief analysis of the characteristic features of all these sedimentation modes is presented. Each mode is found only in a certain range of values of the fiber's aspect ratio N and its elasto-gravitation number B , as shown in a 'phase diagram' of the modes. Our results demonstrate that the dynamics of highly elastic fibers are sensitive not only to B , but also to N .

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