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Buckling and its effect on the confined flow of a model capsule suspension[1] SPENCER BRYNGELSON, JONATHAN FREUND, University of Illinois at Urbana-Champaign — The rheology of confined flowing suspensions, such as blood, depend upon the dynamics of the components, which can be particularly rich when they are elastic capsules. Using boundary integral methods, we simulate a two-dimensional model channel through which flows a dense suspension of fluid-filled capsules. A parameter of principal interest is the equilibrium membrane perimeter, which ranges from round capsules to capsules with an elongated dog-bone-like equilibrium shape. It is shown that the minimum effective viscosity occurs for capsules with a biconcave equilibrium shape, similar to that of a red blood cell. The rheological behavior changes significantly over this range; transitions are linked to specific changes in the capsule dynamics. Most noteworthy is an abrupt change in behavior when capsules transition to a dog-bone-like equilibrium shape, which correlates with the onset of capsule buckling. The buckled capsules have a more varied orientation and make significant rotational (rotlet) contributions to the capsule–capsule interactions.

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