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Nonlinear effects in the dynamics of viscous vesicles in linear flows PETIA M. VLAHOVSKA, Dartmouth College, YUAN-NAN YOUNG, NJIT — Vesicles in a simple shear flow deform into prolate ellipsoids and exhibit at least three (experimentally confirmed) types of behavior: tank-treading (also observed for drops), tumbling and breathing (new features that are unique for vesicles). This non- trivial dynamics originates from the distinctive mechanical properties of the lipid bilayer membrane: the molecularly thin membrane is a highly-flexible incompressible fluid sheet. Several groups have studied vesicle behavior in steady shear flow. The phase diagram suggests that when subjected to linear flow with some variable parameter, vesicle transition between different states can show hysteresis. We examine dynamics of vesicles subjected to time-varying flows: oscillatory shear and linear flows with variable rotational component. Floquet analysis is conducted to investigate the vesicle dynamics and conditions for chaotic shape and flow dynamics are established.

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