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Capillary oscillations of a liquid sphere pinned on a circle-of-contact. PAUL STEEN, ERIC THEISEN, MICHAEL VOGEL, Cornell Unversity, CARLOS LOPEZ, AMIR HIRSA, RPI — The vibration of a sphere is a classical example of the competition between liquid inertia and surface tension. In contrast to the violin string, where pinning raises the pitch, constraining the deformable sphere can lower the vibration frequency. This is known. The lower frequency arises from the activation of an oscillation of the center-of-mass relative to the frame of the constraint, a mode with zero frequency for the unconstrained sphere. The dynamics of this center-of-mass mode is the subject of our study and is important in a number of applications since it is the lowest frequency of the system. Our model restricts deformations to spherical-shaped caps. A tractable description of finite-amplitude motions emerges. Regimes of qualitatively different dynamics are predicted that include: i) small-amplitude vibrations about one of either bistable states; ii) large-amplitude limit-cycle oscillations around the two point-attractors. Predictions are compared to experiment and to previous work that employs the classical model.

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