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A General Mechanism for Negative Capacitance Phenomena
JASON SHULMAN, YU-YI XUE, TcSUH/University of Houston, STEPHEN TSUI, California State University-San Marcos, FENG CHEN, C.W. CHU, TcSUH/University of Houston — Negative capacitance (NC) is a relatively unknown, yet common, phenomenon that is found in a wide variety of materials and devices spanning the major branches of science. The microscopic mechanisms governing NC in these systems are, naturally, as varied as the materials themselves. However, they do share several common features. NC arises in the presence of a *dc* bias, while the materials themselves are nonlinear and possess strong dispersion. The current study focuses on NC in an electrorheological fluid composed of urea coated $Ba_{0.8}(Rb)_{0.4}TiO(C_2O_4)_2$ nanoparticles dispersed in silicone oil. The NC of the fluid is plasma-like in nature and related to the nonlinearity of the fluid's conductivity. A general mechanism, describing the NC of the fluid as well as other materials, has been developed by exploiting the common features associated with NC. The mechanism demonstrates that NC arises from dc/ac signal mixing across a nonlinear conductor.

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