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Simulation of a Magneto-Rheological Fluid Based, Jamming, Soft Gripper Using the Soft Sphere DEM in LIGGGHTS THOMAS LEPS, CHRISTINE HARTZELL, NORMAN WERELEY, YOUNG CHOI, University of Maryland College Park — Jamming soft grippers are excellent universal grippers due to their low dependence on the shape of objects to be grabbed, and low stiffness, mitigating the need for object shape data and expensive force control of a stiff system. These grippers now rely on jamming transitions of dry grains under atmospheric pressure to hold objects. In order to expand their use to space environments, a gripper using magnetic actuation of a magneto-rheological fluid (MR Gripper) is being developed. The MR fluid is a suspension of μm scale iron grains in a silicone oil. When un-magnetized the fluid behaves as a dense suspension with low Bagnold number. When magnetized, it behaves like a jammed granular material, with magnetic forces between the grains dominating. We are simulating the gripper using LIGGGHTS, an open-source soft sphere DEM code. We have modeled both the deformable gripper membrane and the MR fluid itself using the LIGGGHTS framework. To our knowledge, this is the first time that the induced magnetic dipoles required to accurately simulate the jamming behavior of MR fluids have been modeled in LIGGGHTS. This simulation allows the rapid optimization of the hardware and magnetic field geometries, as well as the fluid behavior, without time consuming, and costly prototype revisions.

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