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Experimental measurements of the torque and normal force on a helix rotating in a granular material ROGELIO VALDEZ, Universidad Nacional Autonoma de Mexico, MELANY HUNT, California Institute of Technology, ROBERTO ZENIT, Brown University — The torque and the normal force produced by a helix rotating in granular matter were measured experimentally. The experiments were conducted using the rheometer, with a powder cell, for a wide range of rotational speeds. Two granular media were considered: mustard seeds and glass beads with diameter 0.203 mm. The experiments considered changes in the geometry of the helix. For a first set of tests, seven helices with the same total length but with different helix angle and wavelength were considered. For the second group, ten helices with the same geometric shape but with different numbers of turns, from 1 to 9, were used. The results show that torque and normal force are strongly dependent on the helical geometry. A maximum normal force is reached when the helix angle is around 55 degrees while the peak for the torque occurs when the helix angle is close to 40 degrees. In both cases, the measurements are nearly independent on the rotational speed of the helix. Both force and torque increase linearly with the number of coil turns for small number of coils; however, in contrast to what may be expected for a viscous fluid, the increase is not linear when the number of coils is larger than 3. Comparisons with calculations from granular resistive force theory will be presented.

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