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Acoustic probing of a ball sinking in weakly vibrated dense granular suspensions XIAOPING JIA, SIET VAN DEN WILDENBERG, JULIEN LOPOLDS, ARNAUD TOURIN, ESPCI Paris, Institut Langevin, Paris, France — A convenient method to determine the viscosity of a fluid is to drop a high density ball in it. The ball will first accelerate before it reaches a terminal velocity related to the fluid viscosity. Instead, in a yield stress fluid like a dense granular suspension, the ball will stop sinking at a certain depth due to friction between solid particles. The jamming phase diagram provides a general framework to explain such a transition from a liquid-like state to a solid-like state as a function of packing density and applied shear. However, understanding an intruder sinking in quicksands remains a conceptual and practical challenge. Here, we develop an ultrasound probing to investigate the dynamics of a steel ball sinking in 3D opaque dense granular suspensions under weak vibration. We show that the ball motion in a vibrated granular suspension is consistent with the frictional rheology mu(J) with J the viscous number. Our main finding is that the extracted static friction and viscous coefficients decrease with increasing the vibration intensity, due to vibration-induced contact sliding between particles without significant packing density change. Additionally, we find that these rheological parameters depend on the size of the probing ball, suggesting thus a non-local rheology.

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