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Ultrasonic monitoring in granular suspensions

The dynamics of geophysical dilute turbulent gas-particles mixtures depends to a large extent on particle concentration, which in turn depends on the particle settling velocity. In the first part of this talk, we present the experimental investigation of dilute air-particle mixtures by acoustic probing and air pressure measurements. We show hat there are two settling mechanisms depending on the coupling of the particles with the gas, namely, hindered settling or cluster-induced enhanced settling. These mechanisms result in settling velocities significantly different from those of single particles.

In the second part of this talk we discuss the pratical challenge of localizing an intruder submerged in a strongly scattering medium, such as a dense granular suspension. Here we extract the coherent ultrasonic echo from a steel ball submerged in a dense glass-bead packing saturated by water, by using a standard single-element ultrasonic transducer and configuration averaging processes. Different configurations of the granular packing are created by the nonaffine motion of the beads with a mixing blade, akin to the Brownian motion, in the vicinity of the intruder. We investigate the efficiency of this process to reduce the so-called material noise from multiply scattered ultrasound.

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