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Dynamics of Granular Intrusion Under Localized Point Source Fluidization ANDRAS KARSAI, DANIEL GOLDMAN, Georgia Inst of Tech — Resistive forces during simple intrusion into dry granular media increase rapidly when no additional mechanism anchors the intruder. The increasing lithostatic pressure gradient can prevent unanchored intruders like robots from burrowing without pushing themselves out via reaction force. We investigate in both experiment and CFD-DEM simulations how rapid downward airflow from an intruder's tip can create transient cavities in the media and help reduce resistive force for cylindrical intruders of 3 cm diameter in both 425-850 micron granular sand and 3 mm glass beads. When the fluidizing intruder tip is above the granular surface, the airflow-induced cavities vary from tight downward fountains of flowing grains to wide static craters as the airflow disperses and slows with travel distance. Blow the surface, the resistive force per unit depth on the intruder decreases as a function of airflow rate until a characteristic intrusion depth, where the force increases rapidly and approaches the resistive force for the same intruder with no airflow. Our results show how intrusions' net resistive force depends on the relation between local airflow velocity and external lithostatic pressure due to the two-way coupling of these phases of dense granular solids and localized rapid airflow.

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