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CFD Modeling of Particle Resuspension JASON DEGRAW, JOHN CIMBALA, JAMES FREIHAUT, Penn State University — The phenomenon of resuspension plays a role in everyday life and is an important factor in indoor air quality. There are several models available for particle detachment, but the mechanisms by which particles are induced to lift off of a surface are not well explained in the literature. The lifting forces on a particle are generally too small to resuspend it, especially in the air flows generated by human activity (e.g., walking). We model the interaction of the aerodynamic disturbances and a thin layer of particles deposited on the surface. A standard CFD solver is used to compute the flow, and the particle transport model is one-way-coupled with the flow solution. Several time-dependent flows are considered, including an idealized footstep. The foot is represented using an immersed boundary technique, and is modeled as a disk that moves up and down with a trajectory patterned after experimental gait data. A jet and a radially moving vortex are generated as the foot approaches the floor. The strength of the jet is determined by the details of the foot movement near the surface. If the foot is slowed as it nears the floor, we find maximum velocities around 3 m/s, while the maximum velocity is more than doubled by a sudden stop. We have also computed a "vacuum cleaner" case to model the airflow generated by cleaning activities. In either case, the wall shear along the floor and the near-wall flow structure are used to examine the resuspension of particles.

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