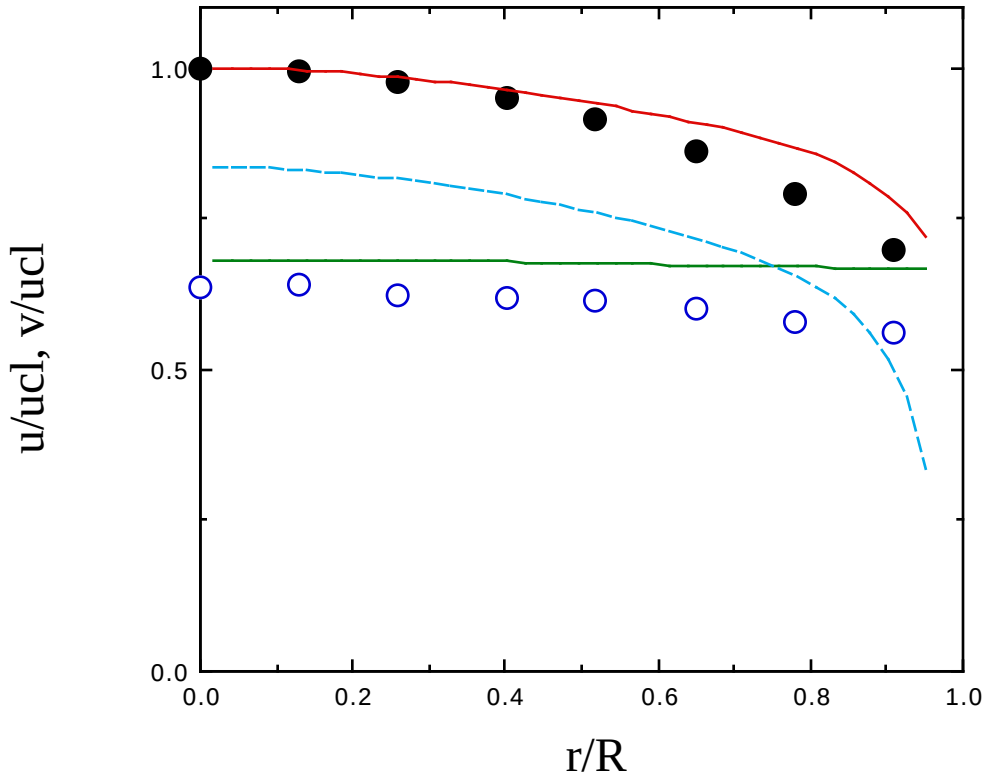
Louge, M.Y., Mastorakos, E. and Jenkins, J.T.: "The Role of Particle Collisions in Pneumatic Transport," *J. of Fluid Mech.* **231**, 345-359 (1991).

We analyze the dilute, steady, fully developed flow of relatively massive particles in a turbulent gas in the context of a vertical pipe. The idea is that the exchange of momentum in collisions between the grains and between the grains and the wall plays a significant role in the balance of forces in the particle phase. Consequently, the particle phase is considered to be a dilute system of colliding grains, in which the velocity fluctuations are produced by collisions rather than by the gas turbulence. The balance equations for rapid granular flow are modified to incorporate the drag force from the gas and boundary conditions, based on collisional exchanges of momentum and energy at the wall, are employed. The turbulence of the gas is treated using a one-equation closure. A numerical solution of the resulting governing equations provides velocity and turbulent energy profiles in agreement with the measurements of Tsuji *et al.* (1984).

Figure excerpts




Calculated profiles of normalized gas velocity $u/u_{cl}$ and particle velocity $v/u_{cl}$ for relatively dilute flows of 500μm particles. The solid and open circles represent the data of Tsuji *et al.* (1984) for gas and particle velocities, respectively. The dashed lines represent particle velocities predicted by an analysis that would ignore particle shear. The conditions are $u_{cl}$ = 9.65 m/s, m = 1.1.