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Particle dispersion in non-stationary and non-uniform suspension flows AMANDA HOWARD, MARTIN MAXEY, Brown University, KYONGMIN YEO, IBM Watson Research Center — In a low Reynolds number pressure driven flow of neutrally buoyant, non-Brownian particles in suspension there is usually an irreversible dispersion of the particles and a net flux towards the central core resulting in a region of high concentration there and low concentration near the walls. Surface roughness and the resulting near-contact forces between particles have been shown to the leading source of irreversibility in suspension shear flows. We report on a series of numerical simulations of particle suspensions in a planar channel for developing flows under both steady and oscillating pressure gradients and for different non-uniform particle distributions. We observe a correlation between the particle pressure associated with contact forces and the development of particle fluxes. In low shear zones, there may be a high number of near-contacts or high coordination number but limited particle pressure. We relate the results to our recent study of suspension plugs where there is a sharp change in particle concentration across a front in the streamwise direction and in oscillatory flow gives a local flux towards the walls. We consider the results in the context of stress balance models and mechanisms generating net particle transport.

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