Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

The suspension balance model revisited[1] PRABHU NOTT, Indian Institute of Science, ELISABETH GUAZZELLI, OLIVIER POULIQUEN, IUSTI - Polytech' Marseille — This paper addresses a fundamental discrepancy between the suspension balance model and other two-phase flow formulations. The former was proposed to capture the shear-induced migration of particles in Stokesian suspensions, and hinges on the presence of a particle phase stress to drive particle migration. This stress is taken to be the "particle stress", defined as the particle contribution to the suspension stress. On the other hand, the two-phase flow equations derived in several studies show only an average force acting on the particle phase, but no stress. We show that the identification of the particle phase stress with the particle stress in the suspension balance model is incorrect, but there exists a well-defined particle phase stress. Following the rigorous method of volume averaging, we show that the average force on the particle phase may be written as the sum of an inter-phase force and the divergence of the particle phase stress. We derive exact relations for these quantities. We also comment on the interpretations and results of previous studies that are based on the identification of the particle phase stress with the particle stress.

[1]Support from the Indo-French Center for the Promotion of Advanced Research is gratefully acknowledged.

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Date submitted: 09 Aug 2010 Electronic form version 1.4