Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

The role of particle-fluid velocity correlation in single-point statistical closures of dispersed turbulent two-phase flows SHANKAR SUBRAMANIAM, Iowa State University — The evolution equation for the dispersed–phase turbulent kinetic energy in the standard continuum model for turbulent two–phase flow contains an unclosed term– the Eulerian particle velocity–acceleration covariance—which is a two–point statistic. A widely-used Lagrangian linear slip–velocity model for the particle acceleration implies a model for this quantity, which depends on the Eulerian *single–point* covariance of velocity between carrier fluid and dispersed– phase particles. However, earlier Eulerian formulations have shown that the particle–fluid velocity covariance in a two–phase flow is a two–point statistic, which is always zero in the single–point limit, because the presence of one phase disallows the simultaneous presence of the other at the same space–time location. This paradox is resolved in this work, where it is shown that this Eulerian single–point covariance of carrier fluid velocity with dispersed–phase velocity is correctly interpreted as a single–point surrogate for the particle– fluid velocity covariance. It is shown that in zero mean–slip homogeneous flows, this surrogate is nothing but the two-phase mixture velocity covariance, which can be expressed as a weighted sum of the velocity covariance in the fluid–phase and the velocity covariance in the dispersed-phase. Therefore, this single– point surrogate for the particle–fluid velocity covariance should not form a part of the set of independent equations in *single-point* closures of turbulent two-phase flow.

Shankar Subramaniam
Iowa State University

Date submitted: 12 Aug 2005 Electronic form version 1.4