2006 Workshop on Multiphase Flow Research
Track 2: Dilute Gas-Solids Flows
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Challenges in modeling dilute gas/solids flows:

- Dilute gas/solids flows where particle-particle interaction (collisions) can be neglected. This flow regime is very dilute where the solids volume fraction is of the order of 0.1% or less.
    - It is known[1] that particles can generate or dissipate gas turbulence depending on the particle size. Need to develop a theory that predicts these effects and design experiments for quantitative validation of models.
- Moderately dense gas/solids flows are known to be unsteady due to the formation of clusters that must be resolved in a simulation.
    - Need validation of sub-grid models[1] to run coarse grid simulations and generalize these models for other types of particles (short term).
    - Need development of reduced order models (ROM) that are capable to predict qualitatively gas/solids flows under different flow conditions. For this purpose, steady-state models can be developed based on correlations derived from transient simulations (short to medium term).
    - Need validation of available polydisperse kinetic theories. Molecular dynamic[2] and discrete element methods can be used for this purpose (short term).
    - Derivation of kinetic theory for granular materials with a size distribution[3] is necessary because most powders used in practice have a PSD. (medium to long term).
    - Need to develop drag correlations for non-spherical[4] particles with PSD (short to medium term).

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[1] Sankaran Sundaresan, John Eaton, Donald L. Koch, Julio M. Ottino. International Journal of Multiphase Flow 29 (2003) 1069–1087.
[2] Janine Galvin, Dahl, S.R. and Christine Hrenya. J. Fluid Mech. 528 (2005) 207-232.
[3] Private Discussions with Rodney Fox (ISU), 2005 and with Matteo Strumendo (IIT), 2006.
[4] Erik Loth (UIUC). Presentation given at NETL (2006).