Challenges in Modeling Dilute Gas-Solid Flows

Two approaches have been used for modeling of gas-solid flows, namely, Eulerian-Lagrangian approach or Eulerian-Eulerian Approach. The Eulerian-Lagranian approach has attracted additional attention since the corpuscular nature of the particulate phase is directly accounted for. The Eulerian-Eulerian approach is, however, more economical for practical applications.

Challenges in Eulerian-Lagrangian Modeling

- Developing two-way interaction Eulerian-Lagrangian computational models for gas-solid flows including particle collisions with heat (and mass) transfer.
    - Two-equation and stress transport type models for gas-solid flows (short term)
    - DNS and LES models for two-way interaction for gas-solid flows (short to medium term)
    - Turbulence modulation for dilute and dense flows (short to medium term)
    - Momentum, heat and mass transfer during particle collisions (medium to long term)
    - Including the effect of particle deposition and resuspension for small particles on gas solid flows (medium term)
    - Extension of the model to include the effect of particle size distribution (long term)
    - Model validation with bulk experimental data (short term)
    - Non-intrusive measurement techniques capable of measuring particles and gas phase instantaneously for detailed model validation (long term)
    - Modeling gas-solid flows including the effect of electrostatic forces and particle surface forces (medium term)
    - Modeling non-dilute gas-solid flows with non-spherical particles (long term)

Challenges in Eulerian-Eulerian Modeling

- Developing Eulerian-Eulerian computational models for gas-solid flows with heat (and mass) transfer.
    - Two-fluid two-equation and stress transport type model including turbulence modulation effects (short term)
    - Two-fluid LES models for gas-solid flows (medium term)
    - Two-fluid models for gas-solid flows with heat and mass transfer (medium term)
    - Two-fluid models for gas-solid flows including the effect of particle deposition and resuspension (medium to long term)
    - Extension of the model to include the effect of particle size distribution (long term)

- Model validation with bulk experimental data (short term)
- Non-intrusive measurement techniques capable of measuring particles and gas phase instantaneously for detailed model validation (long term)

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