MULTI-SCALE SIMULATION OF GAS SOLID FLUIDIZATION BASED ON EMMS-DPM

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This presentation will discuss some efforts to improve the speed and accuracy of discrete particle method from physical models to computational methods.
For physical model, the multiscale method is used. At global scale, the particles are distributed according to global distribution predicted by the Energy Minimization Multi-Scale (EMMS) model, so that the computation domain can be decomposed non-uniformly for load balance. At grid scale, to improve accuracy, the structure dependent drag coefficient based on the EMMS is used. At particle scale, the coarse grained method is used. The size and solids concentration of the coarse-grained particles (CGP) are determined by the cluster properties which can be predicted by the EMMS model. The coefficient of restitution is modified according to the kinetic theory of granular flows (KTGF). The method thus established in called EMMS-DPM(Lu, Xu et al. 2014).
As for computation, using system shared memory, the CFD computation on CPU is fully overlapped with particle computation on GPU. Also, the computation program is coupled with parallel visualization and control program, forming an online interactive simulation platform(Ge, Lu et al. 2015).
This method is verified by the simulation of two different CFB risers and several orders of speedup can be achieved. A methanol to orifin (MTO) process is simulated for more than 6800s. We also simulated a CFB with 30kg 0.082mm particles in 3D full loop. Furthermore, the interactive simulation platform can also be used for education and training purpose since it allows virtual experiment on computers.

REFERENCES

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