

多相流和计算流体力学

稠密气固两相流动的颗粒二阶矩方法及鼓泡床流化特性的模拟

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收稿日期 2009-6-3 修回日期 2009-7-17 网络版发布日期 2009-10-16 接受日期

摘要 采用颗粒动力学方法, 考虑颗粒速度脉动各向异性, 建立颗粒相二阶矩模型。应用初等输运理论, 对三阶关联项进行模化和封闭。考虑颗粒与壁面之间的能量传递和交换, 建立颗粒相边界条件模型。数值模拟鼓泡流化床内气固两相流动特性, 模拟结果表明鼓泡流化床内颗粒相湍流脉动具有明显的各向异性。预测颗粒速度与Muller等和Yuu等实测结果相吻合。预测颗粒脉动速度二阶矩与Muller等实验结果变化趋势相同。统计得到的固相雷诺应力型二阶矩与Muller等实测颗粒脉动速度二阶矩和Yuu等实测颗粒脉动速度相吻合。

关键词

[二阶矩](#) [各向异性颗粒动力学](#) [鼓泡床](#) [数值模拟](#)

分类号

Second-order moments of particles for dense gas-solid flow and numerical flow behavior simulation in bubbling fluidized bed

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Abstract

A second order moment model of particles in dense gas solid flow is proposed based on the kinetic theory of granular flow. The solid phase constitutive model is closed with the approximated third order moment enclosure equation of particle velocity from the elementary transport theory. The boundary conditions of particles are proposed in considering the energy transfer and dissipations by collisions between the wall and particles. Flow behavior of particles is numerically simulated in a bubble fluidized bed, which indicates the distinct anisotropy behavior of the turbulent particles. Simulated particle velocities are in agreement with the measurements by Muller *et al* (2008) and Yuu *et al* (2001). Predicted second order moment of velocity has the same trend as that of measurements. The calculated Reynolds stresses per unit bulk density agree with the measured data by Muller *et al* (2008) and with the fluctuating velocity of particles measured by Yuu *et al* (2001).

Key words

[second-order moment](#) [anisotropy kinetic theory of granular flow](#) [bubbling fluidized bed](#) [numerical simulation](#)

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