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多相流中颗粒旋转运动特性的研究进展

作者: 王勤辉, 杨秋辉, 吴学成, 骆仲泱, 岑可法

单位: 浙江大学能源清洁利用国家重点实验室, 浙江 杭州 310027

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摘要:

多相流中分散相颗粒旋转运动特性研究对于进一步揭示多相流机理有重要意义,同时也有助于人们更全面地认识多相流动,因此,越来越受到学者们的关注。近年来,人们从理论模拟方面研究颗粒旋转对流场的影响,通过改进多相流数值模型来考虑颗粒旋转,获得了与实验吻合的结果,但由于模型本身的局限性,无法全面考虑颗粒旋转运动对颗粒群和周围流场的影响;在实验研究方面,人们尝试利用高速摄像方法测量颗粒的转速,并对实际气固两相流中颗粒的转速进行了测量,但更准确、有效的颗粒转速测量方法还需进一步探索。把直接数值模拟方法应用于颗粒旋转运动特性的模拟是进一步研究颗粒旋转运动特性需要突破的方向,另外,通过计算机视觉场景中的连续图像序列对目标物体进行三维运动和结构重建的技术,也将是颗粒转速测量方法的研究重点之一。

Investigation of dispersed particle rotation characteristics in multi-phase flow is important in understanding the mechanism of multi-phase flow. In previous studies, many people focused on Magnus force produced by particle rotation in solid-gas two-phase flow, and proposed Magnus lift coefficient at different Reynolds numbers through experimental and theoretical investigations. In recent years, many researchers have studied the effect of particle rotation on the flow field through theoretical numerical simulation and dealt with particle rotation by improving multi-phase flow numerical model, and the simulated results are in agreement with experimental results. But because of the limitation of the model, it is impossible to take into full account the influence of particle rotation on particle cluster and surrounding flow field. From the experimental aspect, many researchers use high-speed digital imaging system to measure particle rotation speed and particularly one author successfully measured particle rotation speed in real gas-solid two-phase flow. Nevertheless, more accurate and efficient method needs to be developed. The authors of this paper proposed that the application of the direct numerical simulation in particle rotation characteristics simulation should be the emphasis of research in the future. And the technology of the reconstruction of 3D motion and structure of the object from image sequence in computer vision science should also be paid much attention in particle rotation speed measurement.

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作者简介:

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北京市东城区青年湖南街13号 (100011)

电话: 010-64519489, 010-64519485, 010-64519486, 010-64519490

E-Mail: hgxb@cip.com.cn

京ICP备06025332号

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