

微尺度内流流场数值模拟方法及实验 Numerical Simulating Approaches and Experiment on Micro-scales Flow Field

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关键词: 微通道 流场 数值模拟 粗糙度 多孔介质 微尺度粒子图像测速

摘要: 以Micro-PIV实验测量的微尺度流场为基础,利用Fluent数值计算软件设计最佳微尺度流动数值模拟方案。针对微尺度特性,采用设定壁面粗糙度和多孔介质模拟粗糙元的微尺度效应处理方法,利用Fluent软件提供的realizable k- ϵ 模型和标准k- ω 模型,分别在Reynolds数为100和300情况下对边长600 μm 的矩形断面的微通道内流场水流动进行数值模拟,通过各种数值模拟方案下计算出的速度场与Micro-PIV实验结果的对比,得出以多孔介质模拟壁面粗糙元、配合realizable k- ϵ 模型进行数值计算的方案是微尺度流场CFD的最佳方案。On the basis of micro-scales flow field detected by Micro-PIV experiment, Fluent numerical analytic computing software was utilized to design the optimum micro-scales flow simulating plan. In accordance with features of micro-scales, the micro-scales effect manipulating approaches setting wall roughness element and the porous medium simulating wall roughness element was adopted during the design. In the experiment, using realizable k- ϵ model and standard k- ω model provided by Fluent software, the relative numerical simulations on the rectangle cross section micro-scales water flowing with side length of 600 μm in the case of Re=100 and Re=300 was done. With the comparison of velocity field computed from various numerical analyses and the fitting degree of Micro-PIV experimental outcome, the optimum plan that designing case via the porous medium simulating wall roughness element under the solution of realizable k- ϵ was acquired.

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