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SHUILI XUEBAO

圆形弯管气液两相流数值模拟

Simulation of bubbly two phase turbulent flow in circular pipe bend

中文关键词:气液两相流 双流体 湍流 数值模拟 改进的k-ε模型

英文关键词:bubbly water air two phase flow two fluid model turbulent flow improved κ-εturbulent model numerical simulation

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中文摘要:

采用双流体模型建立了基于贴体坐标和有限体积法的气液两相湍流全三维计算模型，模拟了180度圆形弯管内气液两相流动。模型中连续相(水)采用了考虑分散相(气泡)分布影响的κ-ε两方程的湍流模型；分散相采用代数湍流模型。模型将分散相按气泡分组，可以考虑不同尺寸气泡对流动的影响，提高了计算精度。在两种来流条件下，对180度圆弯管内部三维两相湍流进行了模拟，计算中将气泡按大小分为两组，通过数值模拟获得了弯管内部三维两相湍流的压力、速度和气泡体积率分布等数据。气泡体积率分布的计算结果与实测结果吻合良好。

英文摘要:

A fully three dimensional numerical procedure based on the two fluid model in a curvilinear coordinate system was proposed for calculating the bubbly two phase turbulent flow. In this procedure, the dispersed phase (air) was simulated by an algebraic stress model and the continuous phase (water) was simulated by an improved κ-εturbulent model in which void fraction fluctuations of the dispersed phase are taken into account. In the improved model, the dispersed phase was grouped according to the bubble diameters in order to simulate the characteristics of water air two phase flow with different size bubbles so that more exact results can be obtained. This procedure was applied to simulate the two phase flow in a 180° circular pipe bend under two inflow conditions. The calculated distributions of pressure, velocity and void fraction are given and the void distributions are in good agreement with the experimental results.

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