

前置导叶预旋调节离心泵性能的数值预测与试验 Numerical Simulation and Experiment of Inlet Guide Vane Pre-whirl Regulation for Centrifugal Pump

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摘要: 在分析叶轮进口流态的基础上,给出了一种用于调节离心泵工况点的前置导叶水力模型设计方法,目的是通过减小离心泵在变工况条件下叶轮进口的冲击损失和回流损失来改善在非设计工况的水力性能,拓宽高效运行范围。基于SIMPLEC算法,通过数值求解Reynolds平均Navier-Stokes方程和RNG  $k-\epsilon$ 湍流模型方程,模拟了不同预旋角度下前置导叶离心泵全流道的三维湍流流场,外特性计算结果和试验数据吻合较好。在此基础上,分析了离心泵前置导叶预旋调节的基本规律及调节机理。Based on the analysis of fluid flow at the inlet of the impeller, one kind of hydraulic design method for inlet guide vane was proposed, used to adjust the operation point of centrifugal pump. The goal of the method lies in reducing the incidence loss and recirculation loss and improving the hydraulic performance for centrifugal pump at off-design condition. Based on the SIMPLEC algorithm, the Reynolds averaged Navier-Stokes equation and RNG  $k-\epsilon$  turbulent model equation were solved. Then, the 3-D turbulent flow field of the centrifugal pump with inlet guide vane was simulated with the condition of various angles. Numerical results of operation performance are agreed well with the experimental date. Furthermore, the basic principle and mechanism of inlet guide vane pre-whirl regulation were analyzed.

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