

离心泵前置导叶设计与试验 Design and Experiment of Inlet Guide Vane for Centrifugal Pump

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摘要: 借鉴传统风机前置导叶调节的经验, 并针对其采用的二维翼型在叶片轮毂处由于翼型弦长较短对流体控制能力较差的缺陷, 提出一种全新的适用于离心泵前置导叶预旋调节的空间导叶水力设计方法, 该方法假定前置导叶出口的流体满足等速度矩条件, 通过四次分布函数给定叶片安放角沿轴面流线的分布规律来控制叶片的空间形状, 采用逐点积分法进行叶片骨线绘型, 在圆柱展开面上对叶片骨线双面加厚完成三维空间导叶的水力设计。在此基础上, 将该导叶应用于某离心泵, 并对其在不同轴向位置和不同预旋角下进行了性能试验。结果表明: 三维导叶能够有效拓宽离心泵的高效运行范围, 改善其在非设计工况下的水力性能, 且与无前置导叶工况相比, 最高效率可提高2.0%, 从而达到为离心泵增效节能的目的。 In light of the drawbacks of the 2-D wing, with the reference of traditional adjustments on the blower, a new hydraulic design method for the inlet guide vane was proposed. It was supposed that the fluid at the outlet of the inlet guide vane satisfied the conditions at the moment of uniform velocity. The spatial shape of the blade was controlled by the distributed rule of the blades, which were at staggered angles along the meridional streamline; this could be determined with a quaternary polynomial. A point-by-point integration method was adopted to draw the bone line of the blade. The blade was thickened on two sides on an unwrapped cylinder surface. Once complete, the spatial guide vane was used for a centrifugal pump, and the experiment was performed with the inlet guide vane fixed at various axial positions and pre-whirl angles. The results indicated that the designed guide vane enlarged the high efficiency scope and improved the hydraulic performance of the centrifugal pump. When compared with the performance of the centrifugal pump without inlet guide vane, the peak value of efficiency was enhanced by 2.0% after the 3-D guide vane was installed. This method improved efficiency and saved energy for the centrifugal pump.

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