

前、后置竖井贯流泵装置基本流态分析 Analysis of Basic Flow Pattern in Shaft Front-positioned and Shaft Rear-positioned Tubular Pump Systems

刘君 郑源 周大庆 茅媛婷 张丽敏

河海大学

关键词: 竖井贯流泵 流态 数值模拟 分析

摘要: 利用数值模拟软件Fluent 6.2对雷诺时均N-S方程进行离散,采用S-A单方程模型和SIMPLEC算法对前置竖井和后置竖井贯流泵装置在50%~120%设计额定流量等共16种工况进行了数值计算,并与换算成原型尺寸后的模型试验结果进行了对比,发现性能变化趋势吻合较好,在相同流量下数值计算值与试验值效率误差均在±5%以内。分别对前、后置竖井贯流泵装置的进水流道、泵室段和出水流道在设计流量工况下的基本流态进行了分析和对比,探讨了水力损失的原因。结果表明,前置竖井贯流泵装置的进、出水流态都比较好,而后置竖井贯流泵装置的进水流态均匀平顺,但出水流道的流态比较混乱,水力损失相对较大,装置效率低于前置竖井贯流泵装置;导叶和竖井是影响出水流道流态和装置效率的关键因素,在导叶环量和竖井的影响下极易产生脱流和漩涡。 Numerical calculation was performed with 16 different conditions from 50%~120% of the design flow in shaft front-positioned and shaft rear-positioned tubular pump systems by using software Fluent 6.2. The Reynolds-averaged Navier-Stokes equations were discretized and solved with Spalart-Allmaras turbulence model and SIMPLEC algorithm. The results of numerical simulation were compared with model test data which was converted into the prototype size, and the result of the comparison showed that the tendency of performance change is in good agreement, the efficiency error between calculation data and model data is ±5% under the condition of the same flow. The basic flow pattern of inlet conduit, pump chamber and outlet conduit was analyzed and compared, and the reason for hydraulic loss was investigated. The results indicated that the flow pattern in the inlet and outlet conduit of the shaft front-positioned tubular pump system was good, and that the flow pattern in the inlet conduit of the shaft rear-positioned tubular pump was uniform and smooth. However, the flow pattern in the outlet conduit was in disorder. The hydraulic loss was relatively large, and the efficiency was lower; guide vane and shaft are the critical factors to affect the flow pattern of outlet conduit and arrangement efficiency, stall and vortexes are easily appeared under the influence of guide vane circulation and shaft.

[查看全文](#) (请使用Adobe Acrobat 6.0版本浏览) [返回首页](#)

[引用本文](#)