动力机械与工程

基于正交设计的泵轮叶栅关键参数对液力变矩器的性能影响优化分析

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摘要： 为研究液力变矩器结构对其工作性能的影响，应用正交表安排泵轮叶栅进、出口角参数进行试验设计，借助多重参考系(multiple reference frame，MRF)技术对液力变矩器内流场进行仿真，选择失速变矩比和最高传动效率作为评价指标，分析结构参数对性能的影响。对仿真结果的极差和方差分析表明：增大叶栅进口角或减小叶栅出口角，可降低失速变矩比，同时，最高传动效率也得到改善；叶栅出口角对失速变矩比和最高传动效率都有非常显著的影响，叶栅进口角对失速变矩比显著性影响较小。此外，对结果的回归分析确定了叶栅关键参数对液力变矩器性能影响程度的定量关系，并由此建立了高拟合度的二次回归方程，为液力变矩器的参数设计与分析提供参考依据。

关键词： 液力变矩器 泵轮 叶栅 多重参考系 正交设计

Performance Optimization Analysis of the Effects of Pump Cascade Key Parameters on Torque Converter Based on Orthogonal Design

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Abstract: As orthogonal array was applied to guide experimental design, the effects of torque converter pump structure parameters, including the cascade inlet and outlet angles on working performance, were studied. The simulations of torque converter internal flow were performed by means of multiple reference frame (MRF) technique. The stall torque ratio and the maximum transmission efficiency were selected as evaluation index to investigate the effects of structure parameters on torque converter performance. Based on the range analysis and variance analysis, the results show that with the increasing of cascade inlet angles and the decreasing of outlet angles, the stall torque ratio is reduced, meanwhile, the maximum transmission efficiency of torque converter is improved; The extremely significant influences on the stall torque ratio and the maximum transmission efficiency are originated from cascade outlet angles, while a certain comparative significant difference to the stall torque ratio is from cascade inlet angles. Moreover, the regression analysis determines that the quantitative relationship exists between the key parameters of cascade and their influence degree on torque converter performance. Then, some of high fitting degree quadratic regression equations provide the references of parameters design and torque converter analysis.

Keywords: torque converter pump cascade multiple reference frame orthogonal design

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