

基于动静干涉的离心泵转速测量机理与实验 Experiment and Mechanism of Centrifugal Pumps Rotation Speed Measurement Based on Rotor-stator Interaction

潘中永 倪永燕 袁寿其 李红

江苏大学

关键词: 离心泵 动静干涉 压力脉动 转速 测量 实验

摘要: 离心泵叶轮和蜗壳的相对运动,使流体在叶轮和蜗壳内的流动相互干涉,从而引起周期性压力脉动。通过流场计算发现流体在蜗壳内沿叶片出口边绝对速度方向上出现明显的高速区域;通过对蜗壳内压力脉动的监测发现,叶轮每转过一周,蜗壳内的压力呈周期性波动,波峰和波谷的数量与叶片数相同。通过对压力的频谱特性分析,发现压力脉动的主频就是叶片通过频率。应用高频压力传感器测量泵出口法兰附近的压力,通过FFT变换发现测得的信号主频也是泵的叶片通过频率。根据离心泵内动静干涉引起的压力脉动的这一特征,将泵出口法兰处得到的压力脉动作为测量泵转速的原始信号,采用快速傅里叶变换技术对压力脉动信号进行后处理,得到的主频就是离心泵的叶片通过频率,应用该叶片通过频率可实现对泵转速的测量。 As relative motion is existing between the impeller and volute, periodical pressure fluctuations is produced by the flow interaction of the impeller and volute. Numerical simulations showed that obvious high speed regions were formed along the direction of the absolute velocity in the casing at the down-stream of the trailing edges. The pressure fluctuations in casing present periodical features, have five peaks and five valleys according to the number of vanes. Frequency spectrum showed that the dominate frequency of the pressure fluctuation was the blade passing frequency. Pressure acquisition in experimental test was executed by a high-frequency pressure sensor installed in the pump outlet flange. FFT technology was used to analyze the measured signals, and it also showed that the dominate frequency was the blade passing frequency. A new technology to measure the pump rotating speed was developed according to the feature of the rotor-stator interaction. The original contents were those pressure signals at the pump outlet. The dominate frequency of the contents was calculated by the technology of FFT, and then the rotating speed was calculated.

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

[引用本文](#)