基于自回归模型的水流脉动压力频谱特征研究

Spectral analysis of pressure fluctuation signals of flow using AR method

中文关键词：脉动压力　频谱　谱估计　自回归模型　相似律

英文关键词：pressure fluctuation　spectrum　spectrum estimation　AR method　similarity law

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中文摘要：

以具有4种Fr数、3种比尺共12组工况的水流脉动压力试验数据为基础，提出将基于自回归(AR)模型的现代谱估计方法应用于水流脉动压力频谱特征研究中。分析结果表明：水流脉动压力谱密度曲线平滑、方差小，因不受虚假峰值的影响，谱密度曲线呈窄带有色噪声形式分布，主频率明确；经St数归一化后，Fr数相同的3条脉动压力谱密度曲线在主要频率范围内基本重合，表明水流脉动压力频谱特征在其主要频率范围内满足重力相似律。

英文摘要：

Spectral analysis is an important method in processing experiment data and studying fluctuating characteristic of flow. A classical method based on fast Fourier transform (FFT) has suffered some limitations such as poor frequency resolution, large variance value and spectral leakage. A model based method can eliminate above faults. Experimental data of four Froude numbers and three scales were conducted and data were processed by using FFT based and autoregressive (AR) model based methods. The results show that AR model based method spectrum has better frequency resolution, small variance value and not suffering the shortage of spectral leakage. The power spectral density curves distribute like those of narrowband colored noises and the dominant frequency is clear. Normalizing by Strouhal number, the primary segments of the curves of same Froude number are of superposition and the similarity law of the pressure fluctuation in those portions of flow agrees with the gravity law.

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