基于FFT和闭环采样控制的科氏质量流量计信号处理系统

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摘　要：

针对新型的直管型和微弯管型科氏质量流量计(CMF)基频较高，满量程相位差微小的特点，提出一种以FFT算法为核心，由FPGA硬件逻辑及外围电路实现频率跟踪，通过调整DDS产生可变时钟实现AD采样频率闭环控制的CMF信号处理系统，以满足FFT算法整周期采样的条件，减小由于非整周期截断带来的频谱泄露对计算精度的影响，实现了实时准确的CMF输出信号的频率和相位差的解算。实验结果表明，该系统相位计算误差小于±0.1%，线性度良好，测量频率范围广，在新管型CMF的二次仪表中具有广阔的应用前景。

关键词：科氏质量流量计 二次仪表 闭环采样控制 FFT

Coriolis Mass Flowmeter Signal Processing System based on FFT and Close-loop Sampling Control

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Abstract:

On account of the characteristics of novel straight tube Coriolis mass flowmeter (CMF) such as higher basic frequency and smaller phase difference at scale span, while the current algorithms exist some shortcomings, the FFT algorithm is proposed. The new signal processing system can realize sampling rate close-loop control via FPGA hardware logic and peripheral circuit, to make working frequency tracking. That means the sampling rate can adjust real-time according to the change of the working frequency of the CMF, maintaining the precondition of full period sampling and decreasing the influence of frequency spectrum leakage due to the non-full period truncation. Experiment results demonstrate that the resolution error is lower than 0.1%, the system is of good linearity and large frequency range. It will have broad application prospect in the secondary instrument of new tube type CMF.

Keywords: Coriolis mass flowmeter secondary instrument close-loop sampling FFT

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