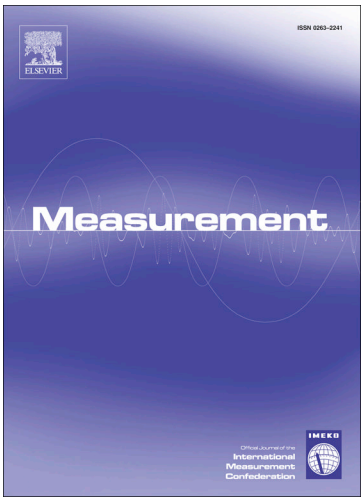

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Energy Peak Fitting of Echo based Signal Processing Method for Ultrasonic Gas Flow Meter

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Abstract: Ultrasonic gas flow meter has unique advantages and it is especially suitable for measuring the gas flow rate in large diameter pipes. However, the energy of the ultrasonic signal is seriously weakened when it propagates in the gas flow, which results in echo amplitude small and susceptible to noise interference. As the measured gas velocity increases, the propagation path of the ultrasonic signal will deviate, which leads to the further weakening of energy and the deviation of the peak points. As a result, it is difficult for the commonly used method to determine the feature point and obtain the accurate measurement, especially in high flow rate. Therefore the characteristics of the ultrasonic echo energy are studied, and a digital signal processing method based on peak fitting of echo energy is proposed for ultrasonic gas flow meter. The relationship between echo energy and EEG (echo energy gradient) is analyzed, and the range of the optimal echo energy point is obtained. Based on this range, one echo energy point is selected, and the value of the echo energy point is selected as a standard to locate the four nearest echo energy peak points for linear fitting. Also, the method of determining the more accurate echo energy peak point is proposed, which further ensures the accuracy of the linear fitting. The echo energy point corresponding to the energy value on the fitting straight line is found as the feature point for determining the arrival time of the echo, and the ultrasonic propagation time is calculated to obtain the gas flow rate. This digital signal processing method is implemented in the digital system in real time, and the calibration experiments are performed to validate the effectiveness of the proposed method and the developed meter.

Key words: Ultrasonic gas flow meter; echo energy; signal processing method; peak fitting; feature point

1 Introduction

Ultrasonic gas flow meter is widely used in metallurgy, chemical industry, large-caliber natural gas trade and other industrial fields [1-2] because of its no pressure loss, large range turn-down ratio, high accuracy and other advantages. Both propagation velocity difference method and