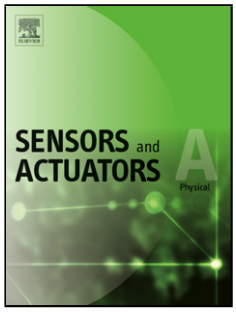

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The measurement of small flow

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Research highlights

- **Measurement of extremely low flows with high time resolution**
- **The use of FFT (Fast Fourier Transform) for decomposition of signal to component depending on pump pulsation and component depending on chemical reaction**
- **The use of electrochemical reaction for flow measurement**

Abstract

The paper presents an electrochemical flow meter. It is based on a principle of measuring a response to chemical reaction which depends on the flow. The ferro/ferricyanide redox couple has reliable and robust electrochemical kinetics. The reaction consists of transfer of one electron and change of solvation structure without any change of complex structure. If the geometry of electrochemical cell is not changed the output current depends only on the flow through the cell. This device enables measurement of extremely low flows which is important in microsystem hydrodynamic studies. Measured flow limit of detection is 100 pl/min. The flow resolution is better than 1 pl/min. Time resolution of flow is better than 1 s.

The device was used in study of peristaltic pump and movable piston pump flow. Sensitive measurement of flow and use of Fast Fourier Transform (FFT) has proved that noise generated by pump is periodic and correlates with the flow. The signal after pump pulsation elimination has white noise. The analysis of sensor signals with FFT in systems with peristaltic pumps or movable piston pumps enables to split the signal to periodic component correlating with the flow and non-periodic component correlating with the measured concentration.

Research highlights

- **Measurement of extremely low flows with high time resolution**
- **The use of FFT (Fast Fourier Transform) for decomposition of signal to component depending on pump pulsation and component depending on chemical reaction**
- **The use of electrochemical reaction for flow measurement**

Abbreviations

FFT – Fast Fourier Transform, EFM – Electrochemical Flow Meter, FeFe - ferro/ferricyanide (see section 3.1)