

## Accepted Manuscript

Title: The measurement of small flow

Authors: Jan Krejčí, Lucie Ježová, Radka Kučerová, Robert Plička, Štěpán Broža, David Krejčí, Iva Ventrubová

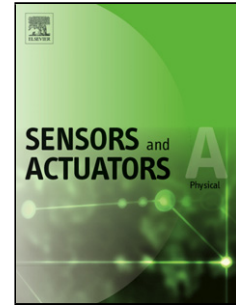
PII: S0924-4247(17)30507-1  
DOI: <http://dx.doi.org/10.1016/j.sna.2017.08.050>  
Reference: SNA 10305

To appear in: *Sensors and Actuators A*

Received date: 26-3-2017  
Revised date: 23-7-2017  
Accepted date: 29-8-2017

Please cite this article as: Jan Krejčí, Lucie Ježová, Radka Kučerová, Robert Plička, Štěpán Broža, David Krejčí, Iva Ventrubová, The measurement of small flow, *Sensors and Actuators: A Physical* <http://dx.doi.org/10.1016/j.sna.2017.08.050>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## The measurement of small flow

Jan Krejčí; Lucie Ježová, Radka Kučerová, Robert Plička, Štěpán Broža, David Krejčí, Iva Ventrubová

BVT Technologies, a.s.

### 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)

Download English Version:

<https://daneshyari.com/en/article/5008163>

Download Persian Version:

<https://daneshyari.com/article/5008163>

[Daneshyari.com](https://daneshyari.com)