

EDITORIAL

Announcing the 2007 *Measurement Science and Technology* Outstanding Paper Awards

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March 2008**

Since 1991, *Measurement Science and Technology* has awarded a Best Paper prize. The Editorial Board of this journal believes that such a prize is an opportunity to thank authors for submitting their work, and serves as an integral part of the on-going quality review of the journal.

The current breadth of topical areas that are covered by MST has made it advisable to expand the recognition of excellent publications. Hence, since 2005 the Editorial Board have presented 'Outstanding Paper Awards' in four subject categories: Fluid Mechanics; Measurement Science; Precision Measurements; and Sensors and Sensing Systems.

2007 Award Winners—Fluid Mechanics

An adaptive sampling and windowing interrogation method in PIV

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The co-authored paper [1] has been selected as the Outstanding Paper in Fluid Mechanics for 2007. This paper provides a strategy whereby the placement and the size of the interrogation regions are adapted to the image signal strength (seeding density) and the spatial variations of the velocity magnitudes. Two, quite distinct, test cases demonstrate the efficacy of their method: a shockwave-boundary layer interaction and an aircraft vortex wake. The Selection Committee—Drs T Fansler, J Foss, I Marusic, S Morris, K Okamoto and M Wernet—selected this paper from a strongly competitive shortlist of four candidates. Their selection process was influenced by the perceived utility of the contribution to the numerous investigators who utilize PIV methods.

2007 Award Winners—Measurement Science

Broadband single cell impedance spectroscopy using maximum length sequences: theoretical analysis and practical considerations

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The paper [2] describes a novel impedance spectroscopic measurement method for applications in the identification of biological cells. The frequency-dependent impedance is obtained in the frequency domain by applying a fast M-sequence transform (FMT), and a fast Fourier transform (FFT) in the time domain response.

Using FMT, the evaluation takes place within a short timescale of the order of milliseconds. This technique is used in a microfluidic impedance cytometer, for the analysis of single biological cells in suspension. The theory of the technique is analysed in depth. It is then applied to an experimental system that characterizes the impedance spectrum of red blood cells within the microfluidic system. Measured spectra show good agreement with simulations.

The paper has a short but excellent introduction, supported by a solid reference list of about 55 papers describing related work. Most of these papers are citations from 2000 onwards. This is followed by a detailed analysis of maximum length sequences and theory used for predictions of spectra. It then continues with a useful description of a cytometer that was used to confirm theoretical predictions of spectra. Results are at an early stage.

The system is still under development, since there are issues arising from the fact that the particle flows during the acquisition of data, and is not static in the electric field as assumed by the model. Nevertheless, the paper possesses good clarity of the motivation behind the work, of the measurement techniques developed and of the potential relevance to applications in the life sciences.

2007 Award Winners—Precision Measurement

Ultraprecision micro-CMM using a low force 3D touch probe

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The paper [3] describes a new three-dimensional coordinate measuring machine (CMM) developed for traceable measurement for small objects. The most sophisticated component of the system lies in the structure of its touch probe. It was designed based on a parallel kinematic mechanism with flexure hinges in order to minimize the moving mass and to ensure an isotropic low stiffness. This head features very weak probing forces, below 0.5 mN, and supports exchangeable probes down to 0.1 mm diameter, realizing a measurement without introducing any plastic deformation on the surface of the object. It was then combined with a highly accurate 90 mm × 90 mm × 38 mm air bearing stage with interferometric position measurement with no Abbe offset, achieving a typical reproducibility of 5 nm in measuring various shapes of the objects.

In order to evaluate the contribution of the shape deviation of the probing sphere to the uncertainty, a new calibration method with three spheres has been developed in this work. In addition, a scanning measurement procedure was also implemented for fast measurement without any loss of accuracy, contributing to practical measurement for users. The selection committee members on precision measurement—Drs K Fujii and A Yacoot—and Editorial Board members Drs P Hauptmann, U Kaatze and M Player, selected this paper from a strongly competitive list of nine candidates. The paper opened a new way for achieving an unprecedented accuracy in coordinate metrology.

2007 Award Winners—Sensors and Sensing Systems

Two-dimensional optical accelerometer based on commercial DVD pick-up head

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The authors describe in this paper [4] a 2D accelerometer that is based on a simple DVD pick-up head. It is a considerable extension of an earlier paper [5] dealing with a similar device but restricted to 1D only. In the awarded paper, not only is the extension to 2D presented, but also a thorough analysis of the system's performance is given. A clear description of the general concept is followed by the derivation of the intensity distribution on the four-quadrant photodetector. In the next section, the design of the mechanical part is detailed, including a FEM analysis for obtaining optimal performance characteristics in terms of resonance frequency, sensitivity and range. The system is extensively tested, and the paper presents a useful selection of the measurement data in graphical and numerical format.

Altogether, theory, experimental and measurement results are presented in a clear and well balanced way, and illustrated with neat graphics. A missing uncertainty analysis is the only deficiency in this otherwise excellent paper.

A sequel to this paper from the same authors appeared a few issues later [6], presenting the DVD head as a nanoscale touch trigger probe. Both papers belong to the top 60 most downloaded papers in the 2007 volume.

The Outstanding Paper Awards, comprising a cash honorarium and certificate, will be presented to the authors of the winning papers at suitable venues in the near future.

The Editorial Board would like to congratulate the winning authors and would like to encourage all researchers to think of *Measurement Science and Technology* as the home for your best submissions.

References

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