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EDITORIAL

Announcing the 2006 *Measurement Science and Technology* Outstanding Paper Awards

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Chairmen of the four working groups, March 2007

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.

2006 Award Winners—Fluid Mechanics

The article '*Molecular tagging velocimetry and thermometry and its application to the wake of a heated circular cylinder*' by Hui Hu and Manoochehr Koochesfahani, published in volume 17, issue 6, pp 1269–1281, was selected by the cognizant Editorial Board Members as the Outstanding Paper in Fluid Mechanics for 2006. This consensus selection was accompanied by the collective judgment that a number of other very strong contributions were published in 2006. These other papers have been added to the 2006 Highlights in the electronic version of the journal.

The paper by Hu and Koochesfahani is recognized for its contribution to the use of molecular tagging techniques in the service of velocity and temperature measurements. The paper clearly articulates the prior state-of-the-art in this area and it communicates the required equipment and procedures to utilize this experimental tool. The capabilities of their technique are made apparent by the simultaneous (u, v, T) observations in the wake of a circular cylinder. The normalized heat flux vectors, $(\overline{u'_j T'})/U\Delta T$, demonstrate one of the beneficial results of obtaining a whole-field view of the velocity and temperature distributions. The authors also have carefully noted the intrinsic limitations of their technique.

2006 Award Winners—Measurement Science

The 2006 *Measurement Science and Technology* Outstanding Paper Award in the Measurement Science category has been awarded to A Minakov, J Morikawa, T Hashimoto, H Huth and C Schick for the article '*Temperature distribution in a thin-film chip utilized for advanced nanocalorimetry*', published in volume 17, issue 1, pp 199–207. In making their recommendation the measurement science working group chaired by Professor Richard Dewhurst gave the following endorsement:

This paper is a fine example of quantitative measurement science. It describes the temperature distribution in a thin (sub-micron) silicon nitride membrane intended for advanced nanocalorimetry. A combination of experimental and

theoretical analysis is used to provide a new insight into sensor performance when monitoring fast gas cooling rates of up to 10 000 $K\,s^{-1}$.

The paper contains an excellent introduction, explaining the value of thin-film calorimetry as a scientific technique for studying the kinetics of thermodynamic processes. It is a powerful technique for the investigation of a wide variety of materials and their phase transitions. In this paper, the authors have clearly explained the issues that arise in monitoring materials in non-equilibrium states generated by high cooling rates. In previous papers, they had already demonstrated the use of a microchip for temperature-modulation nanocalorimetry, as well as picocalorimetry in a differential mode. So this paper was concerned with the temperature distribution in the membrane. Supported by video-thermography, they present a detailed discussion of both the temperature distribution in the membrane and the gas temperature around the membrane. This is an in-depth study, clearly described.

After analysis, they conclude that the thermal conductivity of a gas is not a limiting factor for ultra-fast-cooling experiments. It was unfortunate that this conclusion required some searching for within the paper, since the paper did not contain a concluding section that would have made it even better. Nevertheless, the paper made good use of an appendix for some aspects of the mathematical description, leaving the reader to concentrate on the measurement analysis within the paper. It is well written, with a good set of references.

2006 Award Winners—Precision Measurement

The 2006 *Measurement Science and Technology* Outstanding Paper Award in the Precision Measurement category has been awarded to '*Prototype cantilevers for SI-traceable nanonewton force calibration* by Richard S Gates and Jon R Pratt, published in volume 17, issue 10, pp 2852–2860.

In making their recommendation the precision measurement working group chaired by Dr Kenichi Fujii gave the following endorsement:

This paper describes a new artifact developed for calibrating spring constants of cantilevers for measuring forces in a nanonewton region using a SI-traceable technique. In the field of atomic force microscopy (AFM), accurate calibration of the spring constants of AFM cantilevers has been solicited for estimation of forces applied to samples. In the work described here, new reference cantilevers were fabricated using high-quality silicon-on-insulator (SOI) wafers and calibrated electron-beam lithography so that both the thickness and length of the cantilevers could be precisely controlled. Furthermore, the spring constants of the uniform cantilevers were measured in a SI-traceable way using the electrostatic force balance (EFB) developed at the National Institute of Standards and Technology, resulting in calibrating the very small spring constants ranging from 0.02 $N\,m^{-1}$ to 0.2 $N\,m^{-1}$ with a relative standard uncertainty of better than 2%. This result was also checked by the authors using the conventional Euler–Bernoulli beam theory, showing an excellent agreement between the result and theory. These results thus paved a new way for production of SI-traceable calibration artifacts that could be made available to the AFM community.

2006 Award Winners—Sensors and Sensing Systems

From the many excellent papers on sensors and sensing systems that have appeared in the 2006 volume of MST, the Editorial Board has selected the paper '*Nano-newton drag sensor based on flexible micro-pillars*' by S Große, W Schröder and C Brücker, published in volume 17, issue 10, pp 2689–2697, for the best paper award 2006. In making their recommendation the sensors and sensing systems working group chaired by Professor Paul Regtien gave the following endorsement:

The paper describes a method for measuring drag forces on free or floating particles in turbulent shear flows near a wall. Knowledge about these drag forces contributes to a better understanding of mechanisms that affect turbulent shear forces. The measurement of such small forces (in the nN range) without interfering with the flow itself is considered to be a real challenge.

The method is based on measuring the bending of a pillar (typically 20 μm in diameter) when exposed to flow. The position of the pillar tip is observed through a microscope. Different test particles (up to several hundred μm) can be attached to the top of the pillar. A rheometer generates an adjustable flow along the test particle, whose deflection is then measured.

The paper presents all essential information about the measurement set-up and procedure: analysis of all forces acting on the pillar and test particle, theoretical assessment of the sensitivity, investigation of possible error sources and sensor calibration. A comparison between theory and experiments with respect to bending and drag force (given in graphical form) shows, according to the authors, a convincing agreement. Unfortunately, a more detailed uncertainty evaluation is missing, which otherwise would better support the authors' claim that with improved optics piconewton measurements are possible. Altogether, this is an excellent paper presenting an interesting measuring method for a wide range of particles and with the potential to also measure dynamic drag forces up to a few kHz.

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.