

## Booking form

### Metrology and Optical Testing

9 - 13 November 2009

#### Course fee: £1380

Discounted rates are available for members of professional bodies/trade associations, and group bookings. Details available on request.

Surname \_\_\_\_\_

First name \_\_\_\_\_

Prof  Dr  Mr  Mrs  Miss

Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Telephone no \_\_\_\_\_

Fax no \_\_\_\_\_

E-mail address \_\_\_\_\_

#### Payment

Please find enclosed a cheque for  
£ \_\_\_\_\_  
payable to Cranfield University

Please invoice my company for the full  
amount £ \_\_\_\_\_

Please debit my credit card Visa /  
Mastercard

Card no

Start date

Expiry date

Issue no

Three digit security code (on reverse of card)

Amount £ \_\_\_\_\_

Name of cardholder \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

Please state any special dietary requirements \_\_\_\_\_

#### Course fee

The fee covers attendance, lunch, delegate coffee breaks and full meeting documentation. The fee does not cover travel or accommodation.

#### Cancellations and substitutions

It is regretted that cancellations and refunds cannot be made. However, the organisers will accept substitutions provided that written notification is received.

**Data protection** Please tick this box if you do not wish your details to be held by Cranfield University for the purpose of marketing courses, conferences, research programmes and other associated activities.

For further information contact the Academic Operations Unit:

T: +44 (0) 1234 754176

F: +44 (0) 1234 751206

E: [shortcourse@cranfield.ac.uk](mailto:shortcourse@cranfield.ac.uk)

Please detach and return this form to:

Academic Operations Unit, Cranfield University,  
FREEPOST BF463, Bedfordshire, MK43 0AL  
UK.

## Speakers

#### Paul Comley

Senior Research Engineer at Cranfield with extensive industrial experience within the precision machine tool sector. Specialisms include metrology, machine tool calibration and process development.

#### John Mitchell

An applied physicist with a PhD in optical metrology, Dr Mitchell has experience in modern and applied optics, classical, holographic and speckle interferometry and holography.

#### Paul Morantz

Principal Research Fellow at Cranfield. Paul has an exceptional record in the fields of precision motion control, precision metrology and machine tool development.

#### Chris Sansom

Senior Lecturer in Ultra Precision Engineering and Course Director of the MSc Ultra Precision Technologies at Cranfield. Chris has considerable industrial experience in a range of technologies including semiconductor materials growth, materials assessment and analysis, materials processing, and component fabrication and test.



#### Contact

For further details including registration information please contact:

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Bedfordshire MK43 0AL, UK  
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[www.cranfield.ac.uk/sas/short](http://www.cranfield.ac.uk/sas/short)



## Metrology and Optical Testing

Industrial short course at Cranfield University

9 - 13 November 2009

## Introduction

Metrology is the key enabling technology for ultra precision technologies - "If you can't measure it, you can't make it". Cranfield University and Technium OpTIC (Opto-electronics Technology and Incubation Centre) offer this five day introductory short course in metrology and optical testing which aims to provide the basic science and practice behind the characterisation and measurement of functional surfaces, with a special focus on optical surfaces.

### Course content

- The purpose, science and philosophy of measurement
- Interferometry and optical testing of surface form
- The characterisation of surface texture
- Contact and non-contact measurement of dimension and geometry
- Measurement of displacement.

### Venue

Cranfield University, Cranfield,  
Bedfordshire, MK43 0AL

### Who should attend?

- Engineers working in the machine tool, automotive, aerospace, optics, optoelectronics and semiconductor industries
- Individuals involved in high value precision engineering where accuracy is critical to profitability and success.

### Benefits of attending

On completion of the course, delegates will gain:

- Critical awareness of the fundamental science for the systematic application of measurement
- Ability to critically evaluate component geometry specifications
- Ability to critically evaluate and specify metrology requirements for functional surfaces.
- Ability to demonstrate conceptual thinking for the identification of appropriate task specific measurement procedures in a range of applications
- Critical awareness of current research and performance capabilities for the selection and use of displacement measurement technologies.

### Day one

- 09.00 [Introduction to the purpose and science of measurement](#) - Paul Morantz
- Fundamental concepts and the role of standards
- 10.55 Break
- 11.10 [Review of statistical monitoring of variability - the '6-sigma' objective](#) - Chris Sansom
- Statistical process control and statistical design of experiments
- 13.05 Lunch
- 14.00 [Dynamic measurement](#) - Paul Morantz
- Dynamic and modal analysis
  - Stiffness, damping and dynamic response
- 15.00 [Vision systems](#) - Paul Morantz
- Imaging systems, image processing and metrology
- 15.55 Break
- 16.10 [Co-ordinate metrology](#) - Paul Morantz
- Defining the quality of measurements and factors affecting uncertainty
  - Traceability of measurements

### Day two

- 09.00 [Coordinate measurement machines \(CMM\) I](#) - Paul Comley
- CMM principles, design and applications
- 10.55 Break
- 11.10 [Coordinate measurement machines \(CMM\) II](#) - Paul Comley
- CMM principles, design and applications
- 13.05 Lunch
- 14.00 [Coordinate measurement machines \(CMM\) III](#) - Paul Comley
- CMM principles, design and applications
- 15.55 Break
- 16.10 [Coordinate measurement machines \(CMM\) IV](#) - Paul Comley
- CMM principles, design and applications

### Day three

- 09.00 [Precision temperature measurement](#) - Paul Morantz
- Temperature measurement technologies and thermal compensation strategy
  - Thermal modeling and design
- 10.55 Break
- 11.10 [Characterization of surface texture](#) - Xavier Tonnellier
- 3D surface parameters and standards
  - Stylus and scanning probe metrology
- 13.05 Lunch

### Day four

- 09.00 [Basic optical testing I](#) - John Mitchell
- Classic interferometer designs
  - Interferograms and computer analysis
- 10.55 Break
- 11.10 [Basic optical testing II](#) - John Mitchell
- Phase stepping and shifting concepts
  - Phase shifter errors and calibration
- 13.05 Lunch
- 14.00 [Basic optical testing III](#) - John Mitchell
- Testing optical surfaces
  - Testing diffraction gratings
- 15.55 Break
- 16.10 [Basic optical testing IV](#) - John Mitchell
- Absolute measurements
  - Measurement of surface roughness

### Day five

- 09.00 [Modal analysis](#) - Paul Morantz
- 10.00 [Precision laser metrology](#) - Chris Sansom
- 10.55 Break
- 11.10 [Precision laser metrology demonstration](#) - Chris Sansom
- Renishaw system for linear and rotational displacements
- 13.05 Lunch
- 14.00 [Metrology case studies](#) - Paul Morantz/Paul Comley/Chris Sansom
- Real life case studies to demonstrate theory and practice
- 15.55 Close