

Short course speakers

Pat McKeown, OBE, FREng

Professor Emeritus at Cranfield, previously the Director of CUPE and the Chairman of Cranfield Precision Engineering Group of companies. Presently he is a Director of euspen Ltd.

Dave Allen

Professor of Microengineering. He is the author of the book entitled "Principles and Practice of Photochemical Machining and Photoetching".

Liam Blunt

Taylor Hobson Professor of Surface Metrology at the University of Huddersfield. He has been heavily involved in the development of 3D surface measurement and is the Director of the Centre for Precision Technology at Huddersfield.

Martin Culpepper

Rockwell International Associate Professor of Mechanical Engineering at Massachusetts Institute of Technology (MIT). He is also the Assistant Director of the MIT Laboratory for Manufacturing and Productivity.

Renaud Jourdain

Senior Research Officer at Cranfield having in-depth expertise of Plasma Physics.

Richard May-Miller

Project Engineer at Cranfield Precision with particular experience in control software and metrology for high precision machines.

Paul Morantz

Senior Research Fellow at Cranfield. He has considerable industrial experience in precision machine tool development.

Paul Shore

Professor of Ultra Precision Technologies at Cranfield and previously SKF Group Research and Development Manager of Precision Production Engineering.

David Walker

Director of the Optical Sciences Laboratory at University College London and the Technical Director of Zeeko Ltd.

Ian Walton

An experienced Research Officer at Cranfield, leading the development of high performance grinding processes for aerospace, automotive and optical components. He is also the Research Manager for the Cranfield Innovative Manufacturing Research Centre.

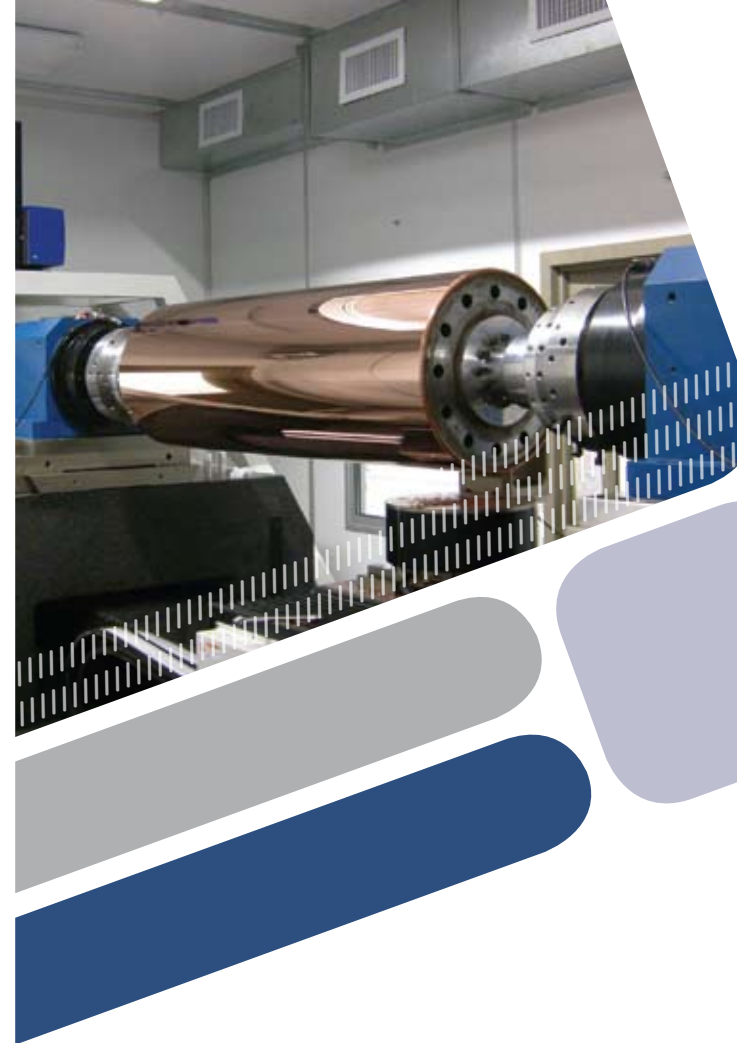
Contact

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Precision Engineering

Industrial short course at Cranfield University

12 - 16 October 2009

Organised by the Cranfield Precision Engineering Centre

Introduction

A highly practical, results orientated five day intensive short course covering the basic principles and state-of-the-art concepts to increase the precision, accuracy and reliability of machine tools and products.

Who should attend?

Engineers working in the machine tool, automotive, aerospace, optics and semiconductor industries. It is highly appropriate to individuals involved in purchasing high value precision engineering facilities where accuracy capability is critical to profitability and success.

Course overview

Gain knowledge to increase the precision, accuracy and reliability of your machines and products

This results orientated course focuses on how you can increase the precision and accuracy of machines, products and processes. Substantial benefits can be gained in a wide variety of applications ranging from ultra precision to traditional mass production. In design and manufacturing, increasing precision and accuracy can multiply opportunities and capabilities and lead to breakthroughs.

In automotive, optics, machine tools, general manufacturing, micro-electronics, instrumentation and other industries, increasing the precision and accuracy can result in products and processes with greater capabilities, better reliability, and higher quality. This in turn can produce higher productivity, better sales potential, higher profits and improved competitive position.

Booking form

Precision Engineering

12 - 16 October 2009

Standard delegate's fee £1380 (this course is VAT Exempt). Please book my place on the Precision Engineering industrial short course:

Surname _____

First name _____

Prof Dr Mr Mrs Ms

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 ^{1st FOUR DIGITS} ^{2nd FOUR DIGITS}
 ^{3rd FOUR DIGITS} ^{4th FOUR DIGITS}

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

We regret that a fee must be charged when confirmed bookings are cancelled or transferred to future dates. 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

Please detach and return this form to:

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

Day four
15 October 2009

09.00 Machine metrology and calibration

- Machine calibration: Parametric, artefact and global techniques
- Metrology frame techniques
- Other design issues

Richard May-Miller

11.00 Break

11.30 Introduction to surface texture and form measurement

- Definitions of surface texture and form
- Methods of evaluation
- Instrument capability review
- Emerging methods

Liam Blunt

13.30 Lunch

14.30 Error budgeting: Geometric and thermal

- Build up of an error budget (concepts)
- Statistical treatment of individual error estimates
- The importance of the error budget at all stages of design

Paul Shore

19.00 Course dinner

Day five
16 October 2009

09.30 Case study design reviews

- James Webb Space Telescope mirror manufacturing

Paul Shore

11.00 Break

11.30 Case study design reviews (cont.)

- Large optics grinding machine evaluations

Paul Morantz/Paul Shore

12.30 Open forum over lunch

14.30 Final adjournment



Gain awareness to help you increase the precision and profitability of manufacturing facilities you develop and purchase

This course will give you the basic precision engineering principles and state-of-the-art concepts for designing higher precision and accuracy into your machines, products and processes, whether they are ultra precision or otherwise.

As an engineer you will find the basic principles to be simple yet powerful tools for improving machine performance; the latest concepts will put you at the forefront of precision engineering technology. The course will emphasize practical information that you will be able to apply immediately and profitably to your design and manufacturing efforts.

Gain a valuable reference manual from the extensive course documentation

You will receive an extensive course manual that includes all the course content and a broad selection of pertinent papers from a variety of sources. The manual will complement the lectures and provide an invaluable reference tool in your workplace.

Find solutions to your 'real' design and manufacturing problems from this interactive learning opportunity

Throughout the course the speakers will encourage your questions, comments and participation. You are invited to come prepared with questions, issues and problems for discussion in relation to your specific design and manufacturing operations. Break times, lunches and evenings provide the opportunity for ongoing discussions with the instructors and also fellow participants. In addition, the final day of the course includes scheduled time for discussion and debate.

Opportunities for discussion with respected, and internationally recognised, precision engineering experts

This course is based on the highly successful short course series developed by Professors Pat McKeown, John Corbett and Paul Shore at Cranfield University. It has previously been provided in Europe, the USA and numerous Asian countries during the last 20 years. With constant updating of content and with newly engaged internationally renowned instructors this course offers a unique blend of the most current technical knowledge.

Day one

12 October 2009

8.45 Registration

Cranfield University

9.00 Welcome and introduction*Paul Shore***9.30 Keynote: Setting the scene**

- Precision engineering and nanotechnology
- The state-of-the-art and a world overview

*Pat McKeown***10.30 Break****11.00 Design of high-precision machines: Analysis, principles and techniques**

- The designer's guide to high precision, covering:
 - stability and optimum support of structures
 - the Abbé principle
 - error compensation techniques
 - drives/carriages

*Paul Shore***12.15 The deterministic performance of machines**

- Fundamental importance of repeatability
- Non-repeatability sources and their reduction and control
- The 'deterministic' position

*Paul Shore***13.15 Lunch****14.00 Kinematic/Semi-Kinematic design**

- Principles: The six degrees of freedom of a body
- Kinematic locations
- Kinematic/Semi-Kinematic design of guideways
- Elastic averaging
- Kinematic representation of real systems
- Case examples

*Martin Culpepper***15.30 Break****16.00 Design of machine structures and flexures**

- Requirements of a structure
- Static and dynamic stiffness
- Load paths-stiffness loop
- Aids to design

*Martin Culpepper***17.30 Social hour**

Hors d'oeuvres and cash bar to be held at Mitchell Hall, Cranfield

Day two

13 October 2009

9.00 Spindle designs for high precision

- Spindle system designs
- Comparison of bearing types
- Axes of rotation
- Examples in precision machine design
- Aids to design

*Paul Shore***10.30 Break****10.45 Slideway designs for high precision**

- Guideway system designs
- Bearing types
- Motional accuracy
- Examples in precision machine design

*Paul Shore***12.00 Materials for precision machine structures**

- Damping properties
- Thermal properties
- Selection criteria

*Ian Walton***12.45 Lunch****13.30 High-precision machine measuring systems**

- Displacement measurement
- Scales vs lasers
- Short-range transducers
- Multi-path interferometry
- Angle measurement

*Paul Morantz***15.00 Break****15.30 High-performance motion actuators**

- DC direct drive motors
- Linear motors
- Application examples

*Richard May-Miller***16.30 Advanced servo and CNC for higher precision**

- Control system methods
- Positioning accuracy
- Optimising dynamic performance

*Paul Morantz***17.45 Visit to ultra precision laboratory****18.45 Adjournment**

Day three

14 October 2009

9.00 Thermal effects

- Gradient and cyclic variation-thermal drift
- 'Energy as an enemy'
- Air shower, liquid shower, and numerical compensation solutions
- Thermal environment for acceptance testing

*Paul Shore***10.30 Break****11.00 Assessment of machine tool dynamic performance**

- Introduction of basic dynamic considerations
- Measurement methods
- Measurement equipment (modal demonstration)
- Evaluation of results
- Case study of modal behaviour

*Paul Morantz***13.15 Lunch****14.00 Ultra precision polishing processes**

- Principles and techniques
- CNC polishing
- Typical examples

*David Walker***15.45 Break****16.00 Non conventional processes for precision engineering applications**

- Micro EDM and ECM
- Excimer and copper laser machining
- Liga processes
- Plasma processes

*Renaud Jourdain***17.30 Break and introduction to euspen Ltd****18.00 Ultra precision diamond/CBN turning**

- Unique process features
- Capabilities, roughness and form
- State-of-the-art applications

*Paul Shore***19.15 Adjournment**