NPL National Physical Laboratory

In association with
CEMMNT
CENTRE OF EXCELLENCE IN METROLOGY FOR MICRO AND NANO TECHNOLOGIES

High Accuracy Freeform Measurement of Optical and Orthopaedic Surfaces

Engineering Measurement Awareness Network

Loughborough University, Loughborough
29 January 2009

Programme

10:00 **Registration and coffee**

10:20 **Introduction** - *Derek Chetwynd, University of Warwick and Richard Leach, NPL*

10:30 **High Precision 3D Measurement of Steep Sided Aspherics in Production Environments-** *Mark Middleton, Taylor Hobson Ltd*

11:00 **On-machine Measurement for Precision Corrective-polishing of Aspheres and Freeform Surfaces -** *David Walker, University College London*

11:30 **Tea & Coffee**

11:45 **Optical Characterisation of Complex Freeform Surfaces-** *Stephen Rolt, University of Durham*

12:15 **NANOMEFOS (Nanometer Accuracy Non-contact Measurement of Free-form Optical Surfaces-** *Rens Henselmans, Eindhoven University of Technology*

12:45 **Lunch**

13:30 **Overview of Metrology in Orthopaedics-** *Cath Hardaker, DEPUY UK*

14:00 **Precision Measurement and Characterisation of Aspheric Surfaces-** *John McBride, Southampton University*

14:30 **Synthetic Aperture Interferometry: An Alternative Approach to In-Process Measurement of Polished Aspherics -** *Jeremy Coupland and Amiya Biswas, Loughborough University*

15:00 **Open discussion and question time with tea and coffee**

(Close at 16.00)

Abstracts of presentations

Mark Middleton, Taylor Hobson Ltd

Production measurement of steep-sided aspherics still presents a significant challenge. Taylor Hobson presents the capabilities of a new profiling instrument, highlighting practical techniques that enable straight-forward 3D measurements and single-click operation.

David Walker, University College London

Corrective polishing requires cycles of measurement and test, substantially increasing process time and handling risk, and suffers limits of dynamic range. We report on a project to integrate form-metrology within a CNC polishing machine, to close the process/metrology loop and extend the range of applicable surfaces.

Stephen Rolt, University of Durham

Precision diamond machining tools are extremely flexible instruments capable of the precise replication of complex surface forms. However, the accurate characterisation of freeform surfaces that lack axial symmetry is extremely challenging. We will discuss the modification of classic interferometric techniques, using non-standard optical arrangements for the precise characterisation of complex surfaces.

Rens Henselmans, Eindhoven University of Technology

Demonstration of the NANOMEFOS measurement machine, capable of fast universal non-contact measurement of optical freeform surfaces, up to 500 mm diameter, designed for an uncertainty of 30 nm.

Cath Hardaker, DEPUY UK

Recent improvements in measurement equipment capabilities and methods have resulted in a higher level of understanding of articulating surfaces for both hip and knee implants. An overview of the state of the art, with respect to wear in particular, will be presented.

John McBride, Southampton University

Consideration is given to the measurement of aspheric optical surfaces using areal surface scanning methods. The characterisation of such surfaces is investigated with reference to two fitting methods. The first indirect method is based on spherical form fitting; while the second method is a direct fitting solution to the aspheric equation used to define the surface under consideration.

Jeremy Coupland and Amiya Biswas, Loughborough University

In contrast with traditional methods, a synthetic aperture interferometer recreates the form of an optical surface from the coherent measurement of the field sensed by a scanning probe. For the purpose of measuring aspheric elements during polishing process, we propose a novel source/receive fibre-optic probe with an anamorphic design.