



University of HUDDERSFIELD

University of Huddersfield Repository

Li, T., Blunt, Liam and Jiang, Xiang

Uncertainty In Surface Roughness Measurement

Original Citation

Li, T., Blunt, Liam and Jiang, Xiang (2009) Uncertainty In Surface Roughness Measurement. In: University of Huddersfield Research Festival, 23rd March - 2nd April 2009, University of Huddersfield. (Unpublished)

This version is available at <http://eprints.hud.ac.uk/id/eprint/5238/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

<http://eprints.hud.ac.uk/>



Uncertainty in Surface Roughness Measurement

T. Li, L. Blunt and X. Jiang
Centre for Precision Technologies,
School of Computing and Engineering, University of Huddersfield,
Huddersfield HD1 3DH, UK



Problem:

For a measurement to be meaningful, a statement of uncertainty must accompany the result. However, surface roughness measurement is relatively immature in terms of the provision of statements of uncertainty and it is usually the case that no statement is provided at all!

Aim:

The aim of this project is to develop and implement a coherent learning system which can be a supplement for existing curricula of engineering studies and higher-level vocational training concerning the uncertainty of surface roughness measurement.

Source of Uncertainty (Stylus Instrument):

- X-Axis
- Z-Axis
- Lc filtering
- Ls filtering
- Stylus tip
- Measuring force
- Sampling interval
- Software
- Inhomogeneity of surface
-

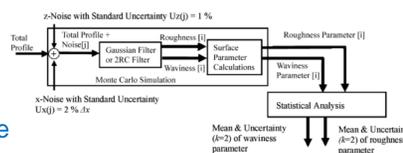
Estimate of Uncertainty:

There are various approaches to obtaining an estimate for the value of a measure together with its associated standard uncertainty. The ISO Guide to the Expression of Uncertainty in Measurement (GUM) is widely used and accepted as an approach to uncertainty evaluation.

In recent times, more general approaches to uncertainty evaluation have gained recognition, including the use of Monte Carlo simulation (MCS). MCS is a computationally intensive approach to uncertainty evaluation, but removes many of the approximations that are part of an approach based on the GUM.

	Nominal	uncertainty	u	u	u	u	u	u	u
x-axis	1	1%	0	0	0,08 μm	0	0	0	0
z-axis	1	1%	0,14 nm	1,2 nm	0	0	0	0	0
λ _c	80 μm	2%	0,06 nm	0,03 nm	0,13 μm	0,007	0	0	0
λ _s	2,5 μm	20%	0,96 nm	10 nm	0,61 μm	0,051	0	0	0
F	1 mN	50%	0,01 nm	0,06 nm	0	0,0003	0	0	0
Radius	2 μm	50%	0,26 nm	1,7 nm	0,02 μm	0,093	0	0	0
Sampling rate	0,05 μm	100%	0	0,15 nm	0,003 μm	0,0012	0	0	0
Noise offset	-	100%	0,05 nm	0,4 nm	0,2 μm	0,0052	0	0	0
Inhomogeneity	-	-	0,2 nm	2,3 nm	0,25 μm	0,094	0	0	0
Total	(1σ)	-	1,0 nm	10,5 nm	0,71 μm	0,142	0	0	0

GUM method

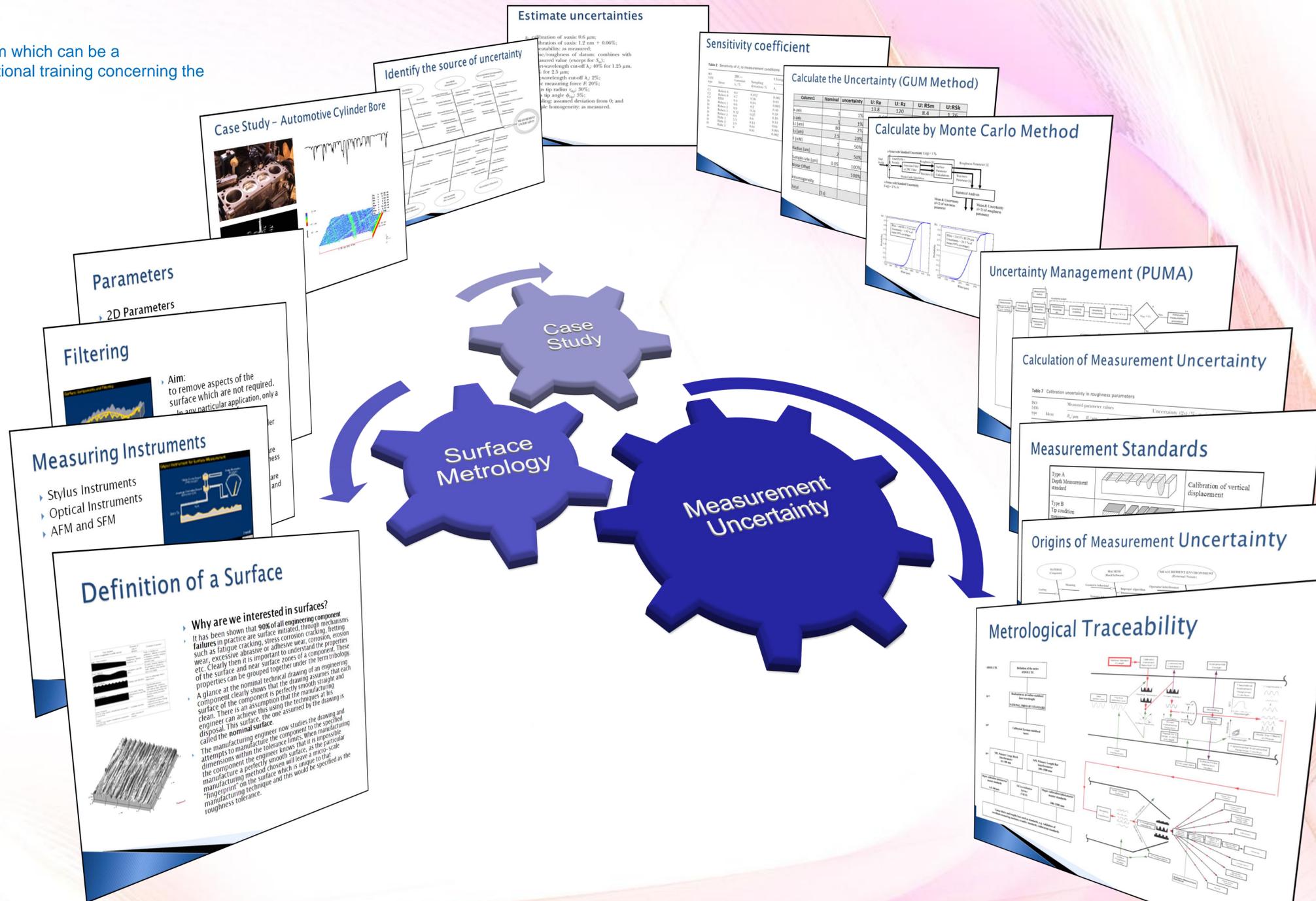


MCS method

Delivery:
This course will be available at:
www.sam-emu.ath.eu



Research Festival
23 March ~ 2 April
09



Education and Culture DG
Lifelong Learning Programme

Acknowledgements:

This project has been funded as part of Lifelong Learning Programme with support from the European Commission.



www.hud.ac.uk/researchfestival