



University of **HUDDERSFIELD**

University of Huddersfield Repository

Zhu, Hao, Blunt, Liam, Jiang, Xiang and Shaojun, Xiao

Measurement and characterisation of micro nano-scale structured surfaces

Original Citation

Zhu, Hao, Blunt, Liam, Jiang, Xiang and Shaojun, Xiao (2009) Measurement and characterisation of micro nano-scale structured surfaces. In: University of Huddersfield Research Festival, 23rd March - 2nd April 2009, University of Huddersfield. (Unpublished)

This version is available at <https://eprints.hud.ac.uk/id/eprint/5219/>

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/>

Introduction

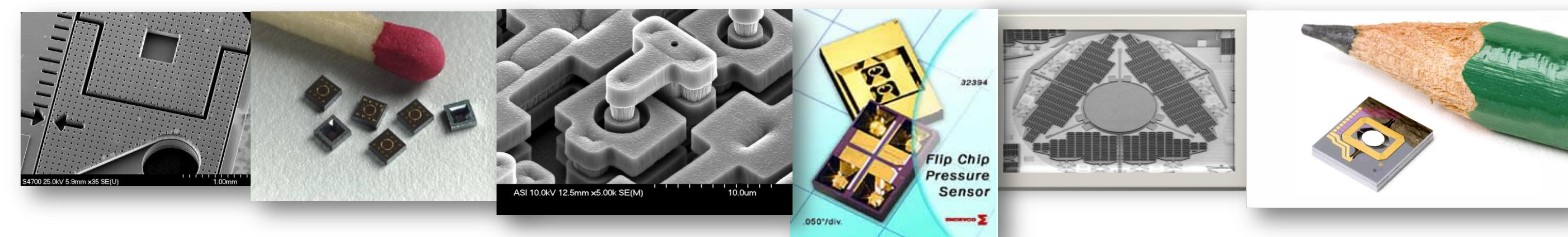
This project aim to investigate basic surface metrology techniques for micro/nano-scale structured surfaces, especially MEMS surfaces. The project will focus on developing a methodology for preparing and conducting the measurement of MEMS surfaces, and further more to study the pattern recognition and characterisation of basic geometry specification of those micro-structures.

Aim

The principle objectives are as follows:

- 1) Develop a thorough understanding of requirement and measurement preparing for micro-structured surface.
- 2) Develop a practical guide of measurement of micro/nano-scale structured surfaces.
- 3) Investigate morph-network techniques for separating those features with consideration of the measurement noise influence.
- 4) Develop the characterisation for those micro-structures in the light of the latest ISO standard for surface feature parameters.
- 5) Establish the pattern recognition and matching between the designing and evaluating of the micro-structured features.

MEMS Micro-structured Surface



Instrument & Measurement Data

●0.01nm Vertical Resolution

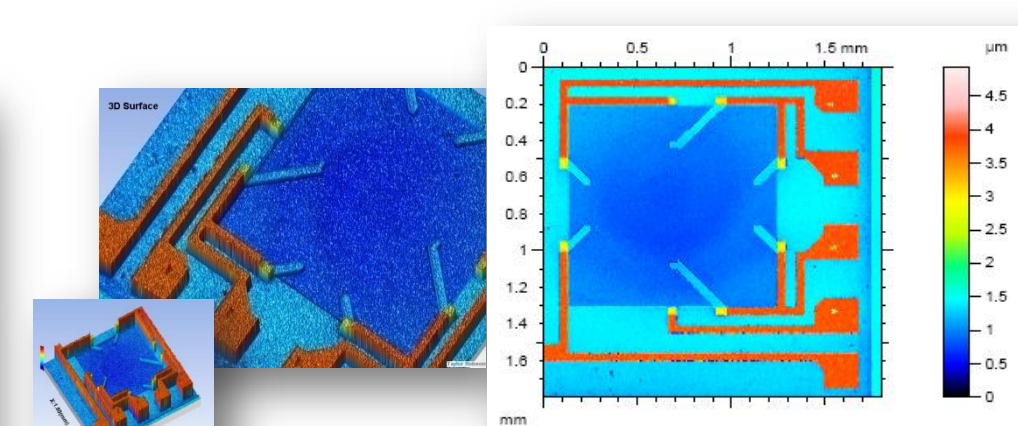
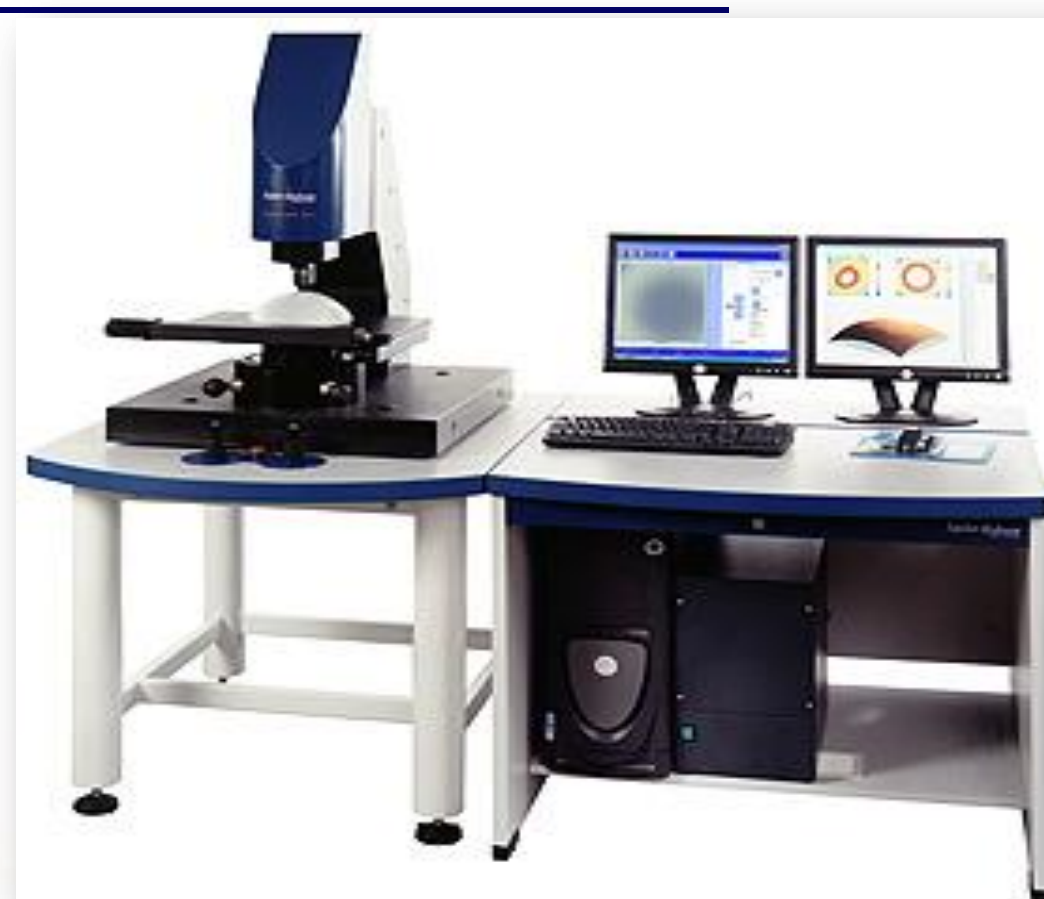
●Quantitative 3D (Areal) Results

●Non-destructive Testing

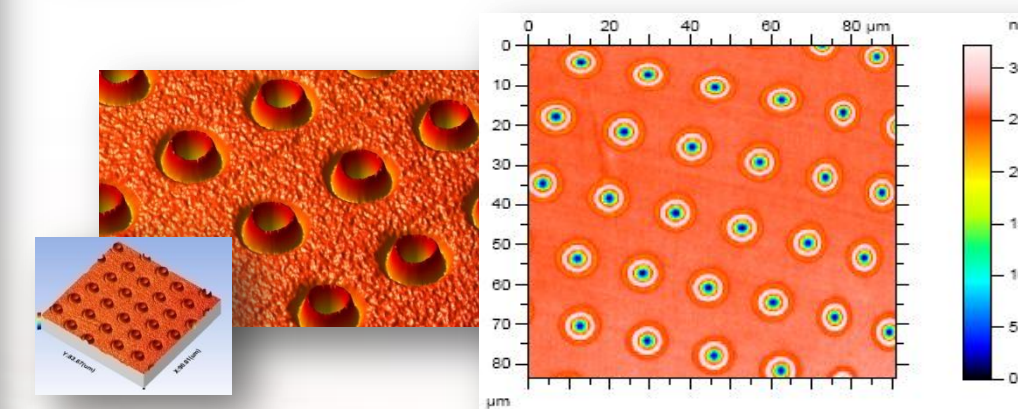
●High Gauge Repeatability

●Low Noise Measurements

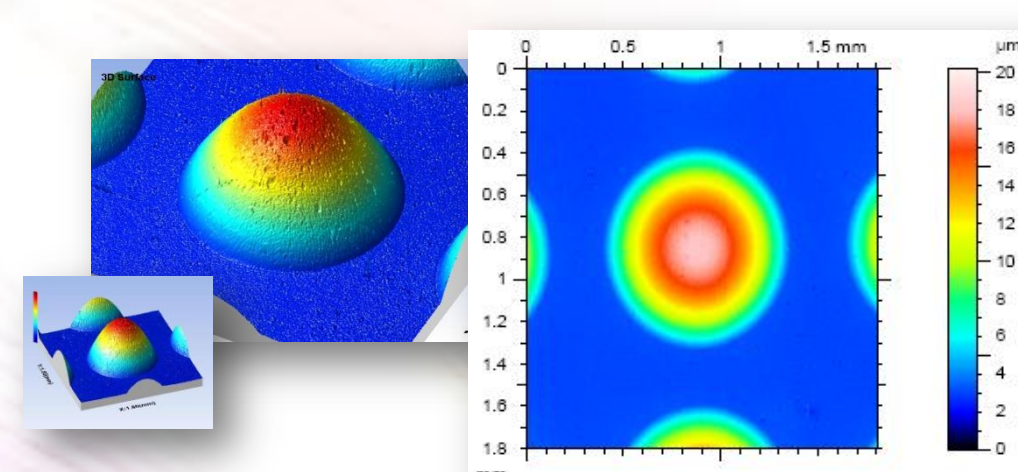
●Measurements Traceable to International Standards



MEMS-Based Sensor



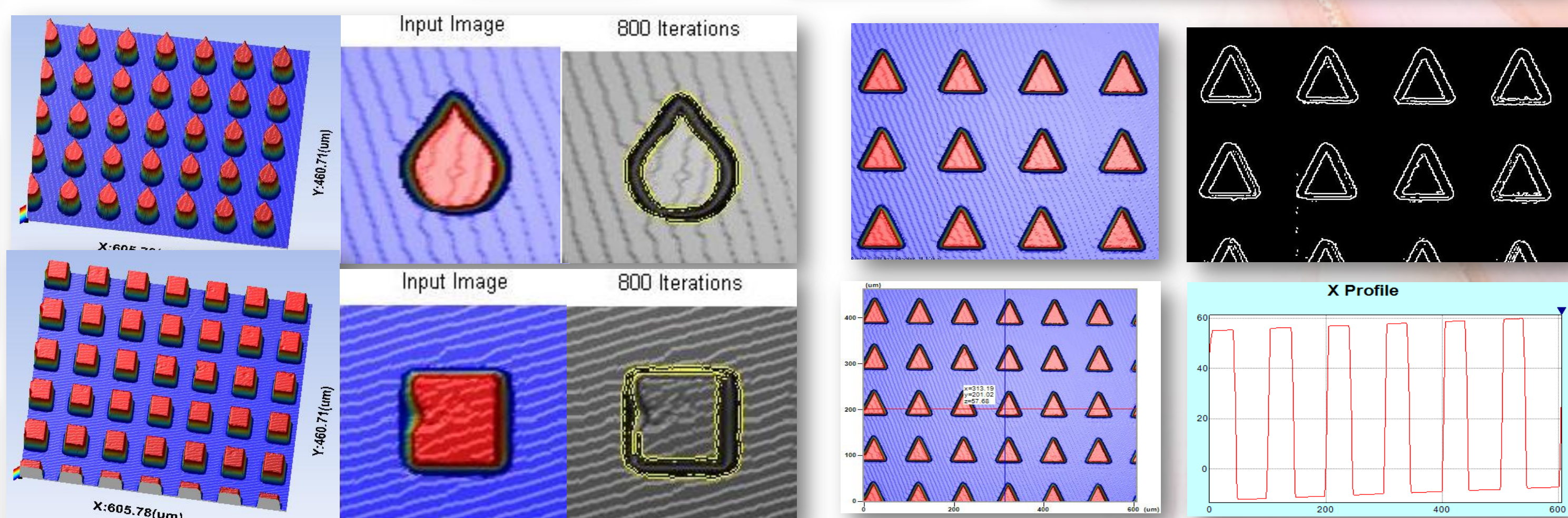
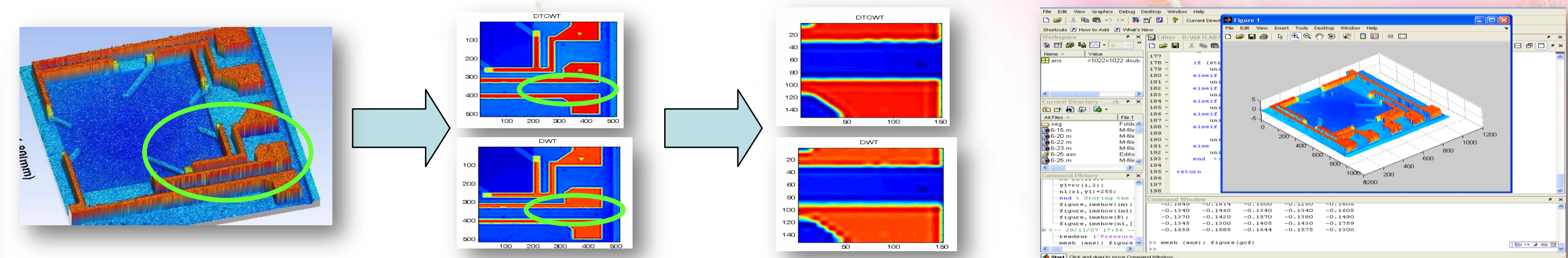
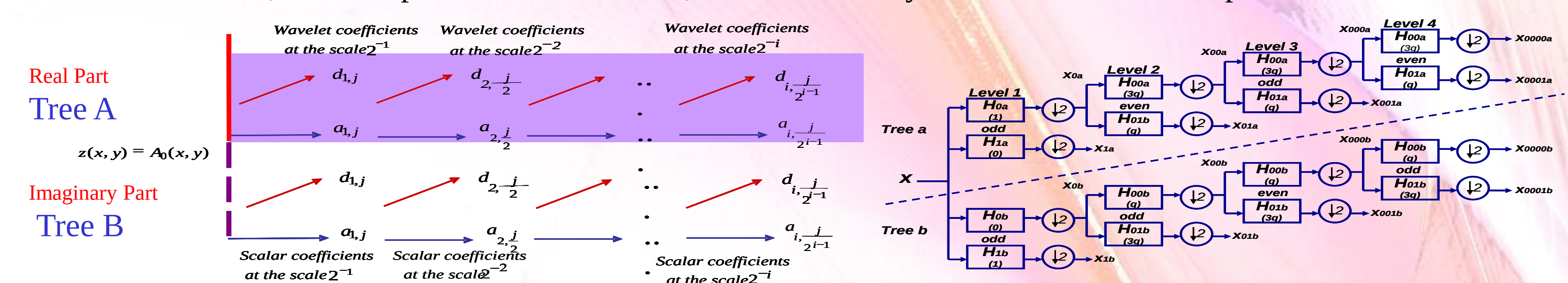
Hard disk surface



Micro-structured Optical Arrays

Experimental Results

A new method for extraction of direction/objective morphological features of surfaces is proposed using a biorthogonal dual tree complex wavelet transform. It attempts to give affine invariance, with independence of the reference frame for the measurements, and also perfect reconstruction, limit redundancy and have efficient computation.



Micro-scale Features Extracted by Active Contour

Edge Detected by Sobel Operator

Conclusions

- A practical measurement scheme is designed for micro/nano scale structured surface, learned the instrumentation operation skill, especially Talysurf CCI System.
- A characterisation method based on wavelet transform is developed and used in surface analysis successfully.
- Established the characterisation method of micro/nano scale structured surface and establish the geometrical fundamental of typical micro/nano structures.
- Some techniques based on the image processing was investigated in surface analysis, for example, edge detection based on Sobel operator.