University of Huddersfield
International Institute for Accelerator Applications

- Target simulation and opportunities of accelerator physics in other applications

Professor Rob Edgecock

Professor Roger Barlow

University of Huddersfield
Centre for Precision Technologies

CERN collaboration

Dr Simon Fletcher – Senior Research Fellow

Dr Andrew Longstaff – Senior Enterprise Fellow

Professor Alan Myers – Group Leader

University of Huddersfield

- Founded in 1825
- A history of education, innovation and
        industrial collaboration
- £140m turnover
- £300m benefit to the local economy
- Over 2,800 staff on payroll
- 24,000 students studying more than 400 degrees
- An international University
  - Students from over 130 countries
  - Delivering courses in China, Hong Kong, India and Singapore

University of
HUDDERSFIELD

- Centre for Precision Technologies (CPT)
  - Specialist engineers in the areas of
    - Machine tool performance
    - 3D Surface metrology and material properties
    - Precision grinding
    - Condition monitoring
  - CPT is the EPSRC National Centre for Innovative Manufacturing in Advanced Metrology

- Facilities within the centre
  - Class 10000 lab for measurement with vibration isolated SEM, AF, Stylus instruments
  - Advanced optical laboratory with four air damped interferometry grade optical tables
  - Machine shop with a variety of 3- and 5-axis machines and full suite of associated metrology equipment
 - Precision control laboratory

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- Engineering Control and Machine Performance research group
- Currently 20 people in the group
  - 14 PhD students
 - 6 senior staff

- All aspects of machine tool technology
- Metrology
  - Rapid calibration
  - Machine capability and error simulation
  - Sensor development
  - Software
  - Training
- Compensation
  - Geometric, thermal and non-rigid
    - Integrated (Siemens 840D, Osai S10)
    - Retrofit system
  - Dynamic modelling
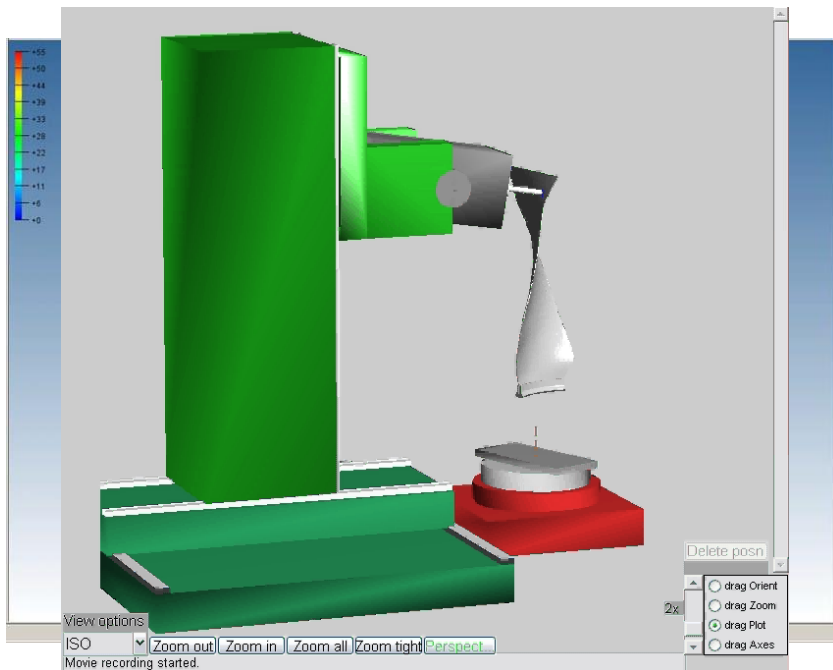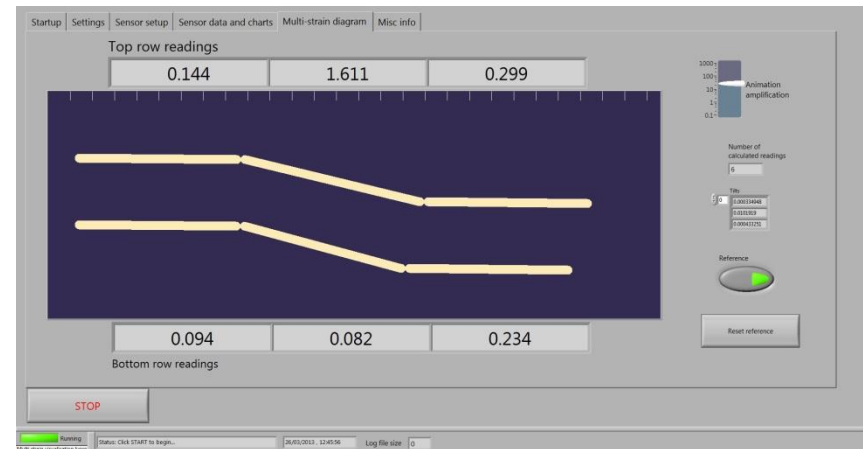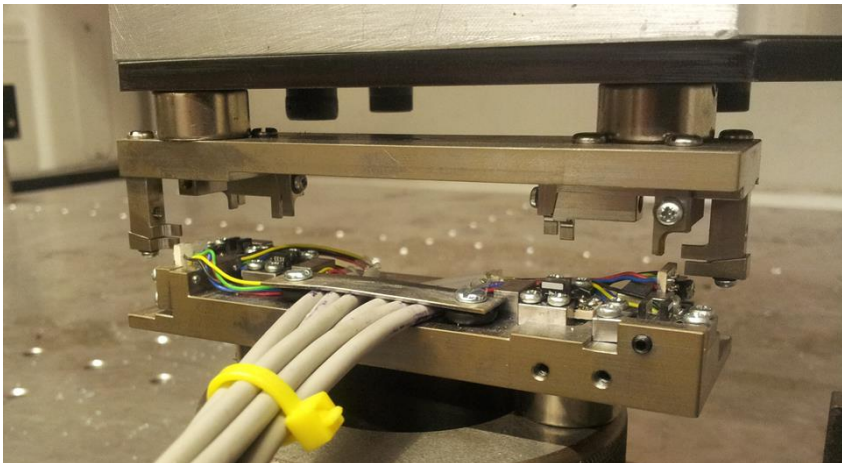
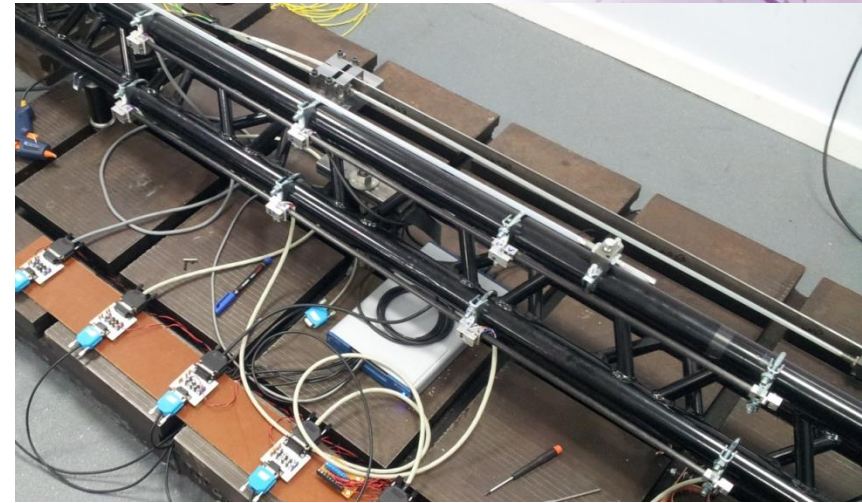- Simulation of mechanical and thermal effects (FEA)
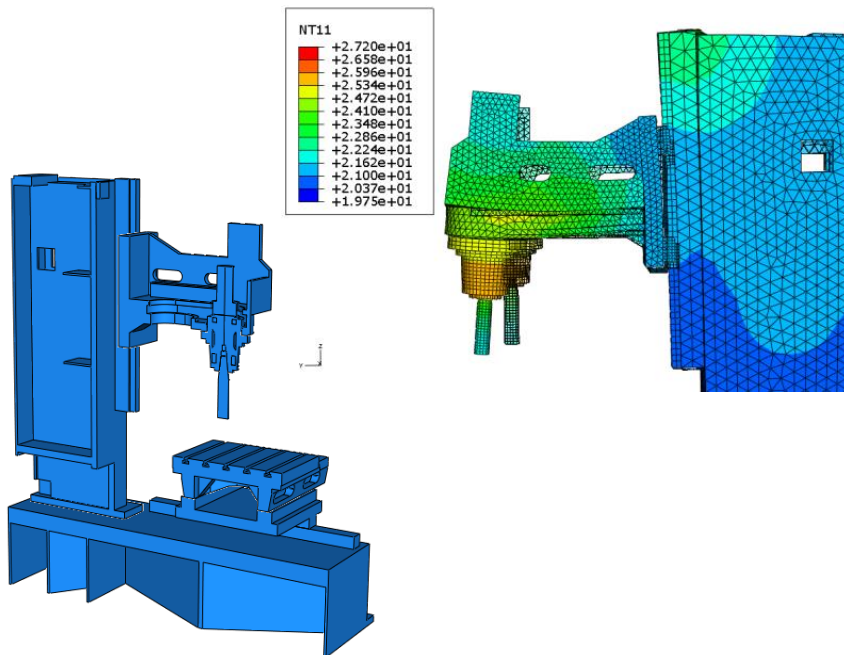
- Servo-drive modelling and adaptive control
  - Simulink and dSPACE
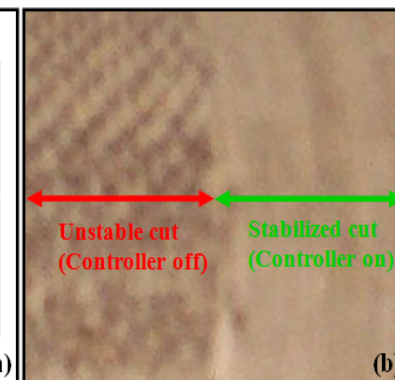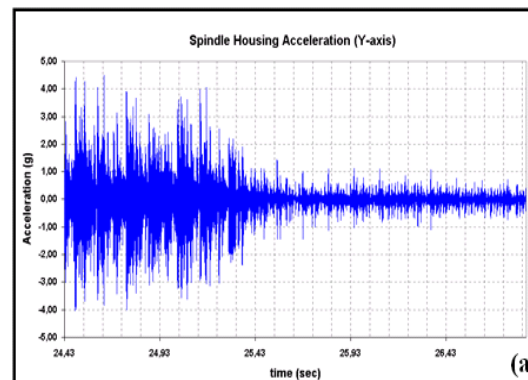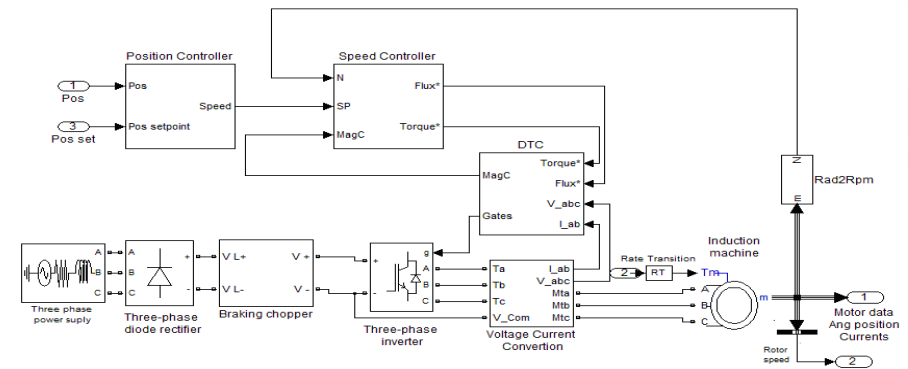
Structural monitoring
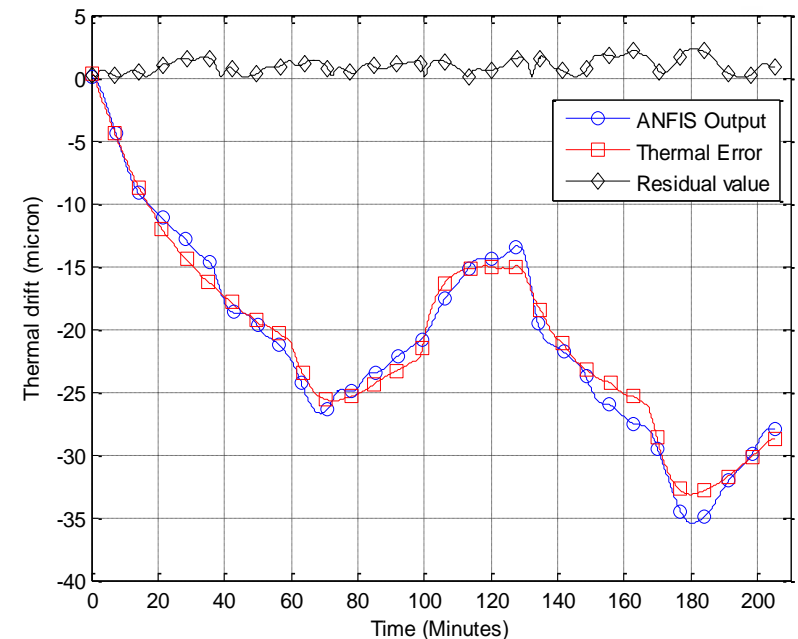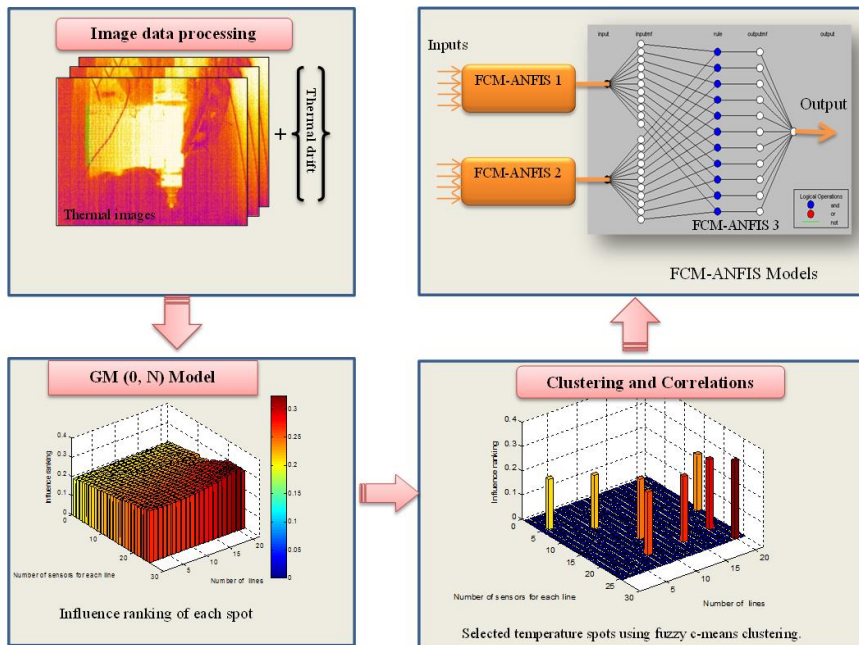
- Phototransistor based prototypes
- up to 6 DoF
  - Non-contact
  - 0.01μm and 0.1μrad sensitivity
  - Ultra low cost
- Multistrain

- ANFIS Modelling and compensation of thermal effects
  - Current inputs include temperature and strain

Block diagram of GRAY-ANFIS prototype.

- Collimator straightness
  - Simulation of the effect of temperature variations due to different running conditions
  - Active compensation to preserve collimator straightness
    - On-line monitoring
    - AI modelling for active compensation and actuator methods
- Collimator positioning
  - Servo controlled collimator positioning system
    - Targeting improved resolution and precision
    - Adapting to mechanical variability due to limited/no lubrication
  - Alternative drive mechanism (possibly adapt from machine tools)
    - E.g. ceramic bearings in roller screw.
    - Linear motors
    - Other (squiggle, PZT,…)
- Due consideration of radiation effects, cabling distances, …

Thank you

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