

Full-field Strain Measurement Workshop: Photoelastic and Thermoelastic Stress Analysis



BRITISH SOCIETY FOR
STRAIN MEASUREMENT

Organisers: Rachel Tomlinson, The University of Sheffield
Richard John Greene, Strain Solutions Ltd.

Meeting information

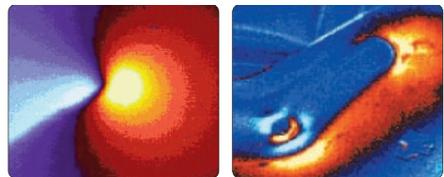
Date: 18th October 2006
Venue: Department of Mechanical Engineering, The University of Sheffield, Sheffield, South Yorkshire

The techniques of photoelastic and thermoelastic stress analysis have both undergone substantial advances over recent years: the development of automated phase-stepping techniques has revolutionised the industrial application of photoelasticity; and the advent of sensitive staring array infrared detectors has led to high quality, commercially available thermoelastic analysis systems.

Whilst both are full-field and non-contacting, there are unique advantages to each technique. Photoelastic analysis enables the difference in principal surface strains, or maximum shear, in a dynamically or statically loaded birefringent material to be determined. Although this requires the component under investigation either to be made from birefringent material itself or to be coated with a suitable strain witness, extensive strain information can be calculated, including the internal strain field using the 'stress freezing' technique. In contrast, thermoelastic analysis enables the change in the sum of principal surface stresses during a loading event to be determined. Surface preparation is either

unnecessary or limited to the application of a thin paint layer, and especially in the case of repeated loading cases such as fatigue testing the technique can provide excellent surface stress data with only a modest experimental effort.

The meeting is primarily intended for engineers and scientists from industry and academia who are either new to the two techniques or who are unfamiliar with the modern experimental methodologies. There will be a programme of presentations in the morning, covering both the theoretical principals behind the techniques with a focus on practical applications and limitations, and also a series of case studies to illustrate some typical experimental applications. The afternoon will then move to a series of laboratory demonstrations, allowing delegates to enjoy some hands-on experience with some state-of-the-art equipment with guidance provided by both experienced research staff and a commercial equipment supplier.



Thermoelastic stress maps around a propagating mixed mode fatigue crack (left) and a window winder mechanism in a door slam test (right).

Programme

- 09:00** Registration and refreshments
- 09:30** Welcome
Dr Rachel Tomlinson, The University of Sheffield
- 09:40** Photoelastic stress analysis: an introduction to the technique
Dr Rachel Tomlinson, The University of Sheffield
- 10:25** Thermoelastic stress analysis: theoretical principles for experimental users
Dr Richard John Greene, Strain Solutions Ltd
- 11:10** Coffee
- 11:25** Photoelastic case studies:
Geoff Calvert, VisEng Ltd
I – Automotive glass inspection
II - Applications of dynamic photoelasticity
- 11:55** Thermoelastic case studies
III – Vibration applications of aerospace components
Dr Richard John Greene, Strain Solutions Ltd
IV – Crack growth through welded joints
Dr Rachel Tomlinson, The University of Sheffield
- 12:25** Lunch

The afternoon will consist of four separate laboratory demonstrations, two each for photoelastic and thermoelastic stress analysis. Delegates will be split into four separate groups and will be given the opportunity to take part in all four demonstrations during the afternoon.

- 13:30** Laboratory session 1
Photoelastic analysis of glass using the Stress Photonics GFP
Thermoelastic crack analysis in near real time
- 15:00** Laboratory session 2
Thermoelastic analysis of vibration and mode shape determination
Photoelastic analysis of three-dimensional stress fields
- 16:30** Closing comments

Booking information

Please complete, photocopy and return to: John Edwards, BSSM Society Administrator
22 St Georges Road, Bedford MK40 2LS, Tel/Fax: 01234 347778
e-mail: johnedwards@bssm.org

Name: _____

Institution: _____

Address: _____

Postcode: _____

Tel: _____ e-mail: _____

Fees

Delegate rate: £130.00 (+VAT@17.5%)

Payment by cheque, credit/debit card (not AMEX) or invoice

Please make cheques payable to British Society for Strain Measurement;
for payments by invoice please quote a purchase order reference number.

Please invoice Purchase order reference:

Card No:

Start date: / Expiry date: / Issue No. (Switch/Maestro only):

Security code (last three digits on back of card):

Venue details

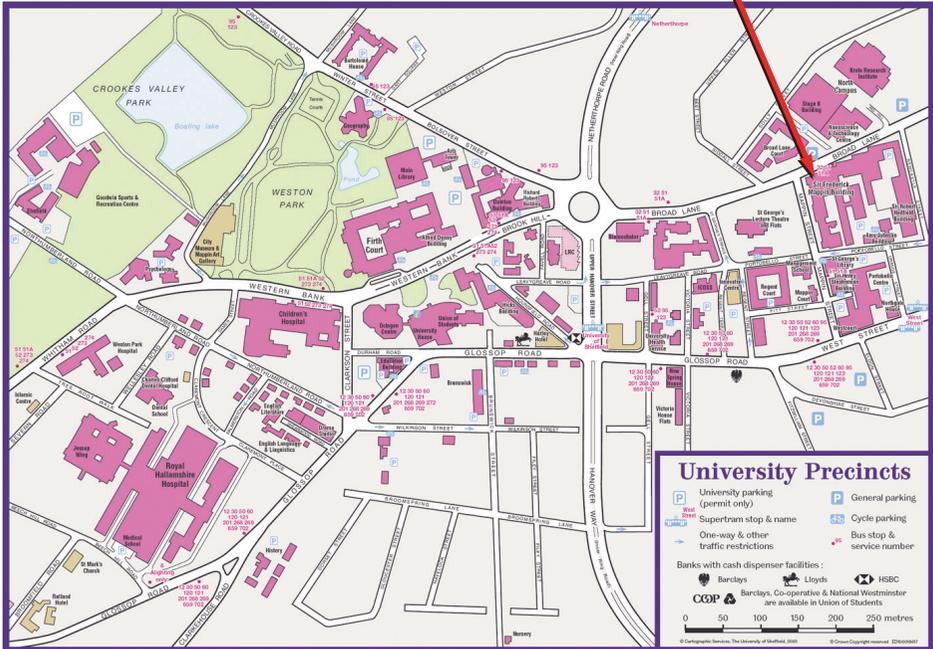


The University Of Sheffield.

The University of Sheffield's Department of Mechanical Engineering is one of the largest and most respected in the UK, consistently achieving high ratings for teaching quality and research. Our industrial partners include Boeing, BAE Systems, Airbus, Ford Motor Company, Rolls Royce, SNECMA Moteurs and several more of the world's leading companies.

With its centre of England location Sheffield is well served by the national road and rail networks, and the city has excellent local transport. Our campus, situated on the western edge of the city centre and also close to the Peak District National Park, is easy to get to by car, bus and tram. A downloadable map and transport information may be found at <http://www.shef.ac.uk/visitors/>

Address
 Department of Mechanical Engineering
 The University of Sheffield
 Mappin Street
 Sheffield S1 3JD



British Society for Strain Measurement.
 Tel: 0845 166 8382 email: info@bssm.org



BRITISH SOCIETY FOR STRAIN MEASUREMENT