The newsletter from the British Society for Strain Measurement  August 2006 Issue 2

A message from the editor...

As the new Editor of Dimensions, welcome to the second issue of this newsletter.

As Professor of Ultrasonics at Glasgow University, it is not always immediately obvious to colleagues why the BSSM is relevant to me and my research. But for many of us in the Society, there are a lot of common themes in experimental mechanics that impact and influence our work. For me, the characterisation of the stress state of materials undergoing ultrasonic processing is a continual challenge, as is the vibration characterisation of ultrasonic tools through experimental techniques such as modal analysis. Stress and vibration analysis are key overarching themes of the BSSM and the Society has enabled me to access academics and industrialists with a wealth of knowledge in these broad areas.

Dimensions is an ideal forum for keeping up to date with what's going on in BSSM and in the experimental mechanics community. This issue is packed with events and courses information, news for members, current research and new product articles. It's a great platform for informing members of upcoming events and the latest measurement and modelling developments so why not contribute to the next issue. We hope you enjoy reading this issue of Dimensions.

Prof. Margaret Lucas, Professor of Ultrasonics
Department of Mechanical Engineering, University of Glasgow, Glasgow G12 8QO
e-mail: m.lucas@mech.gla.ac.uk

The conference themes are:

- Residual stress measurement and prediction
- Vibration based characterisation techniques
- Fracture and damage assessment
- Fatigue studies and determination of remnant life
- Structural health monitoring
- Remote sensing
- Full-scale testing
- Full field stress and strain measurement techniques
- Strain gauge applications
- Impact behaviour of materials and structures
- Mechanical characterisation of fibre reinforced materials
- High temperature stress and strain measurement
- Non-destructive evaluation of damage
- Mechanical characterisation of biomaterials
- Measurements at the micro and nano scale

The BSSM International Conference on Advances in Experimental Mechanics 2007

Abstracts are now being accepted for the fifth conference in the series, which will be held at The University of Manchester, UK, from 4-6 September. The 2007 conference continues the theme of recent advances in all aspects of Experimental Mechanics. The aim of the conference is to bring together researchers in academia and industry to present novel work and to facilitate discussion and interchange of ideas. The focus of the conference is 'Measurement and Testing', however papers are welcome that cover analytical and numerical techniques that are used in conjunction with experimental work and advances in data analysis techniques.

The deadline for abstract submission is 13 November 2006. For more information contact www.bssm.org/conference2007
Open cellular lattice structure research at the University of Liverpool

The University of Liverpool currently has a large scale research activity in open cellular lattice structures, supported by £2m from EPSRC, Industry and EU Framework 6. A manufacturing technique, using the rapid prototyping method of selective laser melting, has been developed to realise open cellular lattice structures with a resolution of 50 micrometers. In the manufacturing process, a layer of metallic powder (e.g. stainless steel with particle diameter of the order of 20 micrometres) is selectively melted using lasers, and hence cellular structures can be built up in 50 micrometer layers.

Figure 1 shows a cellular structure formed into blocks of side length 25mm. Two cell sizes are shown, namely 1.25mm and 2.5mm. The work at Liverpool is focussing on using these cellular structures as cores in twin skinned sandwich panels, with conventional carbon epoxy for the skins. The specific application is in next generation aircraft fuselage structures subject to foreign object impact, e.g. tyre or runway debris.

The selective laser melting manufacturing process can realise a large number of cellular geometries. Cellular structures can be graded and can change geometry through the twin skinned structure. Hence there is scope to optimise the cellular structure for a given application, using such mathematical techniques as topology optimisation.

From the experimental stress analysis point of view, there are a number of interesting research issues. Failure of the cellular structure under various modes of loading is dependent on the cell configuration. Figure 2 shows the failure of a cellular structure under uni-axial compression. Such phenomena as strain localisation and strain softening are encountered. An important issue being addressed at Liverpool is the computer simulation of the progressive collapse of such cellular materials, and the associated development of effective and homogenised continuum material models, for analysing the progressive collapse of cores in twin skinned structures.

For more information contact Bob Mines, Email: r.mines@liv.ac.uk
Acknowledgement: The research is supported with contributions from MCP and Sandvik Osprey.

Figure 1: Two examples of an open cellular lattice structure manufactured using the selective laser melting process (cell sizes 1.25mm and 2.5mm, strut diameter 100 micrometers)

Figure 2: An open cellular lattice structure during uni-axial compression. Note plastic buckling of vertical struts.

Membership of the Society of Environmental Engineers

BSSM members can apply for Registration with EC(UK) as CEng, IEng or Eng Tech through a Joint Membership arrangement with the Society of Environmental Engineers (SEE), which is a full licensed member of the Engineering Council.

BSSM members electing for this route to registration must fulfil the normal requirements of the SEE registration process as laid down by the Engineering Council (UK), Registrations will be subject to Engineering Council (UK) audit, and payment of registration fees. For information about the SEE registration process visit www.environmental.org.uk or from the SEE office (office@environmental.org.uk tel: 01763 271209).

For information on EC(UK) Registration and joint membership with the SEE contact John Edwards: tel/fax: 01234 347778 or email: johnedwards@bssm.org

Safe Technology new release of fe-safe™

Safe Technology, Sheffield, UK March 15 2006. The latest version of the durability analysis software for FE models, fe-safe™ 5.2, includes a number of major enhancements along with the eagerly awaited add-module, Verity™. Verity™ in fe-safe™ marks the first commercial introduction of Battelle’s methodology, the new mesh-insensitive structural stress method for fatigue evaluation of welded structures.

The Verity™ method can be applied to structural welds in thick plate, seam welds in thin sheets, and spot welds. Benefits of the methodology are that the equivalent structural stress is calculated at the weld, not at some distance from it; A single S-N curve can be used, so there is no need to ‘classify’ the welded joint. The method is insensitive to the mesh density and element types used in the FEA; The same S-N curve can be used for structural welds in thin and thick plate, and to seam welds, spot welds, laser welds and other weld types.

Verity™ has been developed in collaboration with more than a dozen leading engineering companies, Battelle’s Joint Industry Project (JIP), and has been verified by correlating the results of more than 800 sets of welded joint fatigue test data. The applicability of Verity™ to any area of industry where the fatigue life of welded structures and components is an issue, has profound implications for product design in terms of performance, quality and cost.

Distributed Processing in fe-safe™ 5.2 allows a single analysis to be spread over multiple processes, gaining significant increases in speed when dealing with large models or complex analyses. fe-safe™ is ideally suited to distributed processing because it analyses each node separately, i.e there is no nodal interdependence to slow the analysis down.

Benchmarks indicate that substantial savings in analysis time can be achieved. fe-safe™ automatically splits up, queues and remerges the job. Plus, once you’ve hit ‘analyse’, the client computer is free to set up the next task. Analysis-only licenses can be purchased to utilize this feature or, if you already hold multiple fe-safe™ licenses, there is no additional cost!

The Extended Materials Database included as standard in fe-safe™ now contains more materials and more data per material. In fe-safe™ 5.2 there are equivalent specifications, chemical compositions, heat treatments and failure criteria for close to 500 material entries including steels, irons, titaniums, aluminium alloys, copper and more.

Visual Loading Definition is the new GUI allowing easy set up of complex loading histories. All the complex loading definitions previously requiring editing of textual .idt files are now available at the click of a mouse.

Pre-Scanning of FEA Models is an enhancement that provides the option to pre-read an FEA model. It provides a list of what can be read from the model and the user selects appropriate data sets to be read in. This option provides another means of speeding up the analysis without compromising on accuracy.

For more information visit www.safetechnology.com

For more information on any of the events advertised in Dimensions contact the BSSM on 0845 1668382 or info@bssm.org

SMALL ADS

Good home wanted for complete set of Strain issues 1964 to present day

Professor Peter Stanley wishes to give away his complete set of Strain. This may be of interest to a library or institution who want to complete the set. For more information please contact the Editor of Strain at r.mines@liv.ac.uk
EMex - 6th Annual Exhibition of Experimental Mechanics

6 September 2006, University of Bath.
Venue: Department of Engineering between 10am and 4.30pm.

The BSSM’s 6th Annual Exhibition of Experimental Mechanics, EMex, will take place alongside the International Conference on Modern Practice in Stress and Vibration Analysis, organised by the Institute of Physics Stress and Vibration Group.

Exhibitors attending EMex

CEDIP Infrared Systems Ltd
Thermal cameras. Stress Analysis equipment.

Dantec Dynamics

GOM UK Ltd
Optical measurement devices for 3D form and strain mapping.

Imetrum Limited
“The Video Gauge” – a video-based instrument for measurement of displacement and strain on materials components and structures.

Instron
Materials testing.

LaVision UK Ltd
LaVision UK are specialists in scientific imaging and provide image correlation systems for non-destructive shape, deformation and strain field measurements of solid and granular flows. This optical measurement tool is applicable to many types of materials and over a wide range of scales; from scanning electron microscope subjects upwards. It is also applicable to any experimental time scale with the ability to measure ultra-fast deformations.

LDS Test & Measurement Ltd
Design and manufacture of vibration test equipment and data acquisition systems.

LIMESS GmbH/ Correlated Solutions.de
Systems for the optical measurement of motion, deformation and strain. Measurement of deformation/strain map with Vic-3D and Vic-2D. Real-time strain measurement with RTSS and Vic-Gauge. Shearographie and ESPI systems.

LMS UK Ltd
LMS develop and supply data acquisition systems and noise and vibration analysis software. Their test lab and virtual lab software products provide the most complete test and design suite available today.

Photo-Sonics International Ltd

Photron (Europe) Ltd
High-speed video cameras.

Si-Plan Electronics Research Ltd
Si-Plan builds test machines with extensive experience in design, manufacture and installation to meet customer requirements/test specifications in the automotive, aerospace, rail and pharmaceutical sectors. Test machines include servo-hydraulic fatigue, tensile, compression and torsional machines with a full range of accessories. Si-Plan can refurbish most material test machines.

Strainstall UK Ltd
Stress analysis, strain and vibration measurement services.

Techni Measure

Vishay Measurements Group UK Ltd
Stress analysis products. Bonding service.
THE BSSM RUNS THE FOLLOWING COURSES

Strain Analysis.
Stress Analysis and Load Measurement.

The Strain Analysis course provides an introduction to electrical resistance strain gauges and the associated circuits for strain measurement and transducer applications. It covers the installation of foil gauges using cyanoacrylate and epoxy adhesives, inspection of installations, the measurement of strain and load, and the use of rosettes to determine principal values.

One day workshops and two day courses covering basic bonding and wiring techniques are run by companies who are corporate members of the BSSM.

CERTIFICATION of STRAIN MEASUREMENT PERSONNEL

The BSSM’s certification scheme promotes good practice in strain measurement, and confirms the competence of a strain gauge user by awarding a formal qualification.

The scheme operates at three levels consistent with the European Standard EN473:1993, General Principles for Qualification and Certification of NDT Personnel.

Experience over a period of 30 years has shown that the certification scheme:
- Demonstrates staff and organisational competence to external bodies
- Increases staff confidence
- Extends skills and understanding and consequently staff interest
- Enhances staff status within the company

Scottish Region

Strain gauge workshop
in conjunction with Vishay Measurements Group UK Ltd at Robert Gordon University, Aberdeen. 25 October 2006

Torque workshop
in conjunction with HBM UK Ltd at Strathclyde University, Glasgow. 28 March 2007

Plastic behaviour of pipes
Venue tbc, Aberdeen. 25 April 2007

MTEC 2007

The Society will once again have a stand at the annual MTEC exhibition which is taking place at the National Exhibition Centre, Birmingham on Wednesday 14th and Thursday 15th February 2007. MTEC is the only UK show dedicated wholly to sensors, measurement and instrumentation and is growing year by year. Our eyecatching stand with its banners bearing the new Society logo and bullet points setting out the key areas of the BSSM’s activities attracted substantial interest at the 2006 event.

This time we are giving our corporate members who are not exhibiting independently the opportunity to showcase their products and services on the BSSM stand. To find out more contact Biana Gale (bianagale@bssm.org) on 0845 166 8382. Further information about MTEC itself including a list of visitors to the exhibition in 2006 can be found at http://www.mtecexhibition.co.uk/wksems07.html.

As well as the stand, the Society will also be running a free workshop in the exhibition hall on Thursday 15th February from 11.00 to 13.00. The workshop will consist of a series of topical presentations by major players in the strain measurement field. More details about the workshop will be available nearer the time.

BSSM contact details:

Chairman
Dr Richard Burguete
Airbus UK Ltd
NTC-D1 New Filton House
Filton, Bristol. BS99 7AE
richard.burguete@airbus.com

Vice Chairman
Dr Janice Barton CEng CPhys
University of Southampton
School of Engineering Sciences
Highfield, Southampton, SO17 1BJ
janice@soton.ac.uk

What are your views on Society activities? Do you have an interesting technical problem you would like to solve? Send your letters and comments to the Society Manager at bianagale@bssm.org

To advertise in Dimensions or to submit an article please contact the BSSM on 0845 1668382. email: bianagale@bssm.org