Instrumentation, Analysis & Testing Exhibition

2 April 2019, Silverstone Race Circuit

Bridging the Gap between the Virtual & Physical Worlds.

ENGINEERING INTEGRITY SOCIETY

MINI SEMINAR PROGRAMME

KEYNOTE: The Route towards Smarter Testing of Aircraft Structures - Ian Jones, Airbus

Within the aircraft manufacturing industry, structural tests of airframe structures have traditionally been used as the means of compliance for aircraft certification. In this approach a test pyramid is used that requires physical tests, ranging from simple coupons to full airframe structures.
Advances in numerical simulation have enabled Predictive Virtual Testing (PVT) techniques to predict structural behaviour, allowing the possibility of replacing physical tests. In other industries, such as automotive, the use of PVT has allowed reduced product development times whilst at the same time increasing product maturity and optimisation.
This presentation outlines a Smarter Testing approach proposed within Airbus that challenges the requirements for physical validation at all of the test pyramid levels and, depending upon the maturity of the technology, either a PVT or a structural test, will be used to qualify the component.

Roads and how to incorporate them realistically into the virtual world - Gordon Airey, University of Nottingham & Jan Prins, Jaguar Land Rover

A joint presentation by Prof. Gordon Airey and Jan Prins about what constitutes an asphalt road surface, and how this can be represented in the virtual world, so that vehicle dynamics behaviour in the physical world can be accurately predicted from simulations.

Tuning an automotive exhaust for sound quality - Mark Burnett, HORIBA MIRA

Automotive exhausts are engineered for both sound level and sound quality. The former is a legislative requirement whereas the latter is to enhance the customers' experience. The advent of hybrid vehicles has not diminished this requirement; merely changing it to include feedback to the driver.
This presentation describes the testing, simulation and correlation of exhaust orifice noise. The process begins with the test characterisation of an exhaust system across a range of engine speed and load conditions. A 3-D acoustic model of this exhaust is created and the transmission loss, orifice noise and noise at the driver is compared with that measured on the vehicle.
Finally, a jury evaluation is used to define a filter that gives the exhaust noise a sporty bias. This filter is used as a target for and optimisation exercise where the exhaust's internal geometry is changed in an iterative manner to converge on this target sound.

How Simple is as Simple as Possible? - Peter Heyes, HBM Prenscia

Albert Einstein said "It can scarcely be denied that the supreme goal of all theory is to make the irreducible basic elements as simple and as few as possible without having to surrender the adequate representation of a single datum of experience". This statement is often paraphrased as "Everything should be made as simple as possible, but not simpler". This is a useful principle to apply to engineering models, though the engineer's aims may be more pragmatic than Einstein's. It can certainly be applied to the modelling of fatigue damage where the need is for answers accurate and reliable enough to support design decisions, but achievable at a reasonable cost and in a timely manner. This work considers the question in the title in connection with the characterization and modelling of fatigue performance in short glass fibre reinforced polyamides – materials widely used in automotive and other industries.

Best Practice Materials Data Management – ensuring quality, traceability, and return on investment - Steve Laine, Granta Design

How do you ensure an efficient, traceable materials testing and analysis process – from test lab to design data? Without such a process, time is wasted in finding the right data or repeating tests and you can't optimize the properties used in design or simulation. This makes it difficult to ensure maximum performance from products and materials. At Granta Design, we've been working since 1994 with industry leaders including the Material Data Management Consortium (members include Rolls-Royce, NASA, Boeing, Airbus Helicopters, GKN, and Honeywell) to develop best practice approaches and supporting software tools that help engineering enterprises to control, manage, and apply materials data. We'll show the results of this work and discuss how you could save cost and time, avoid error, and maximize return on investment from materials testing and qualification programs.

Bridging the Gap between the Virtual & Physical Worlds – A perspective from the Off-Highway Construction & Agricultural Equipment Industry - David Panni, JCB

Off-Highway equipment in the Construction and Agricultural Sectors covers a very large range of machine types and potential applications. The virtual validation of these machines undoubtedly offers many advantages in terms of cost, time to market and quality. However, there are a number of challenges in the practical adoption of virtual processes, alongside existing and well established physical validation processes. This presentation will outline what these challenges are and how they are managed when designing welded steel fabrications at JCB, the world's 3rd largest manufacturer of Off-Highway Construction equipment.

Experimental Dynamic Substructuring: how to create Test Based Models for FEM - Dennis de Klerk, Mueller BBM

FEM modelling has long been used in product development. For complex products like cars, building a FEM model usable for NVH up to the driver's ear and into higher frequency ranges is however still challenging to say the least. Electric vehicles increase this challenge due to their excitation up to higher frequency ranges. To overcome this challenge, this presentation introduces experimental Dynamic Substructuring. This method enables FEM modelling of, for example, the complete vehicle acoustics based on component models from either FEM or test. These test based models originate from modal like measurements.
Substructuring with test based models was first experimented in the 1980s, but technological breakthroughs during the last 15 years now enable robust application of the method as will be shown with use cases.

Virtual Prototyping using a Driving Sound Simulator and Binaural Transfer Path Analysis / Synthesis - Bernd Philippen, Head Acoustics

In the automotive industry NVH engineers would like to judge as early as possible the sound of a new vehicle because late changes are very expensive. High costs, shorter development cycles and an increased number of derivates are the reasons that many car manufacturers are reducing the number of prototypes more and more. But how can you experience the sound properly without a prototype? The answer is a driving sound simulator. Binaural Transfer Path Analysis and Synthesis can combine vehicle and testbench data with data from CAE to build a virtual prototype.
For example, a new engine measured on a testbench can be virtually integrated in different cars using measured or simulated transfer functions. In an early development step, a hybrid approach combines measured vehicle data with simulated changes of order levels vs. phase.
An interactive driving sound simulator creates added value to simulation data. Driving a virtual car supports the decision-making process. It is easier to convince colleagues and management if they can hear and feel the difference because experience is more meaningful than looking at diagrams. In the next step what-if-scenarios can be made audible by changing the TPA model or including new simulation data.
In this presentation the concept, applications and some examples are shown.