CASE STUDY

The University of Glamorgan
Automotive Component Testing

United Kingdom

Automotive and Industrial Consultancy, Education

PULSE, NVH Applications, Transducers, Sound Level Meters

The University of Glamorgan, located at Pontypridd in the idyllic South Wales countryside, has a highly acclaimed Mechanical Engineering department. In addition to providing an excellent mechanical engineering eduction, the department carries out extensive research and uses its advanced facilities to provide consultancy services with major focus on the automotive and electronic industries. Brüel & Kjær's PULSE™ platform is used for a wide variety of tasks including troubleshooting, product design and development, component and material testing, and quality assurance applications.

History

Pontypridd is situated at the confluence of the Taff and Rhondda rivers, north-west of Cardiff. In 1992, the Polytechnic of Wales became the county's second university, the University of Glamorgan.

The university has a well known and highly acclaimed Mechanical Engineering department. In addition to providing an excellent mechanical engineering education, the department carries out extensive research and uses its advanced facilities to provide consultancy services to a wide range of industries. The automotive and electronic industries are the major focus and the university has built strong relationships, especially with the automotive industry, working with major vehicle manufacturers, assembly plants and sub-suppliers.

The university helps companies to solve problems and educates the mechanical engineers of the future.

Unique Experience

Fig. 1
Senior lecturer and consultant, Bill Hague

Senior lecturer and consultant, Bill Hague, has worked at the University for more than 25 years, as has his colleague, Ray Delpak. Bill's expertise is in noise and vibration; Ray specialises in structural dynamics. Bill took an apprenticeship in marine engineering before gaining his BSc. at the University of Strathclyde. Following his degree, Bill undertook research work at Salford University and then moved to the gear division of David Brown where he worked as a noise and vibration engineer. Bill moved south, working at Bristol-Siddeley Engines prior to joining the teaching staff at Pontypridd. He is a member of the Institute of Mechanical Engineers and is a Chartered Engineer. Bill says, "I spend about a third of my time teaching, one third on research work and a third as a consultant for UGCS." UGCS Ltd. is the consultancy company operated by the university.

Consultancy

Fig. 2
A part of one of the department of mechanical engineering's laboratories – the university has extensive facilities

The department works on general noise and vibration issues with a special focus on component testing for the automotive industry. Structural dynamics and material testing are particular areas of interest. To ensure confidentiality and to maintain the department's reputation for high quality, Bill Hague and his colleagues perform all the external work themselves. With the permission of the client, students are permitted to see the final results and case studies. Bill Hague says, "Our aim is to create knowledge and develop testing techniques using the latest technology."

The list of automotive companies working with the university is impressive, including:

- Honda
- Nissan
- Solvay Automotive
- Fram Filters
- Ford
- Jaguar
- Rover
- Toyota

Recent work has been conducted on such aspects as:

- The use of high density plastics for bumpers, expansion tanks, air intake ducts, etc.
- Fluid dynamics in power steering and brake applications
- Quality assurance evaluation
- Batch testing of components
- Vibration testing using shakers
- Pressure testing
- Product development
- General troubleshooting

Specifications and appropriate testing procedures are agreed with the customer in advance.

Bill Hague says, “Automotive manufacturers are out-sourcing increasing numbers of components to sub-suppliers. Specifications are constantly getting tighter and these are driven by the automotive manufacturers who impose tough conditions.” Bill continues, “We use our facilities and experience to help our customers to meet these demands.” The fees charged are competitive with the commercial sector.

The university has done research into hand-arm vibration problems. Bill says, “This type of work is increasing and we want to do more. Occupational health, comfort and safety are very big issues these days.”

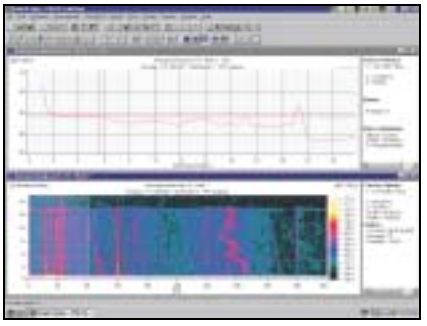
Facilities

Fig. 3
A climatic chamber in one of the laboratories

The mechanical engineering department has a number of laboratories that are used for research purposes and consultancy work. The illustration shows a climatic chamber where the temperature can be accurately controlled from -40° to $+140^{\circ}$ C. The large shaker below the chamber can subject components to vibration tests over extended time periods. As an example, a rear “spoiler” was vibration tested continually for 80 hours.

PULSE™

Fig. 4
A typical PULSE™ display for NVH analysis



The University of Glamorgan has recently purchased a five channel Portable PULSE™ system and has an extensive range of software including a Data Recorder. Other Brüel&Kjær products include shakers, impact hammers, transducers, sound level meters and other noise and vibration analysis equipment. This includes a Type 2031 single-channel analyzer (the first in the U.K.) and a Type 2032 dual-channel analyzer that is still regularly used.

PULSE™ is used for a wide variety of tasks including troubleshooting, product design and development, component and material testing, and quality assurance applications. The university is doing increasing amounts of modal analysis using PULSE™. Together with “Star” software, the 4+1 channel front-end enables a hammer and four accelerometers to be used. Bill Hague says, “Experience dictates where the transducers are placed on the test item. The built-in generator is a very useful facility.” Bill continues, “Most of our NVH (Noise Vibration Harshness) analysis is narrow-band FFT. I like to make cross-correlations using both microphones and accelerometers. This can be done in real-time and we can immediately see which “components” agree and which disagree. We can find answers very quickly.”

PULSE™ runs under Windows NT® and is connected to the main university LAN (Local Area Network). The data is archived on ZIP drives and CDs. The PULSE™ software automatically generates reports in either Word or Excel, depending on the application and the wishes of the customer.

Bill says, "We find PULSE™ very logical. It's easy to set up and use. Some of our students in their final year are allowed to use the system for special projects. I give them a copy of the "PULSE ™ Getting Started Guide" and they find it easy – it's great experience for them."

Confidence

Bill Hague says, "I have personally used Brüel & Kjær equipment since the 1960s and their products are, in my opinion, the finest available for noise and vibration analysis". He continues, "Their equipment does precisely what it says in the specification, and Brüel & Kjær's specifications are tighter than most of their competitors. Both we and our customers have complete confidence in the equipment and the accept the results. Bill finishes by stating, "And we get excellent service, support and training from the Brüel & Kjær U.K. office."

Sound Level Meters

Fig. 5 *2260 Investigator™. The University of Glamorgan uses the instrument for many projects*

The university has a number of sound level meters including Type 2260 Investigator™. These are used for a variety of purposes including industrial noise investigations, noise surveys, occupational health investigations, frequency analysis, etc. 1/3-octave analysis is most common.

Using their experience, Bill and his colleagues identify the problems and propose solutions. 2260 Investigator™ is also used extensively for sound power calculations of products. This is especially important with the new EU Noise Emission Directive.

The university has a Type 2230 sound level meter purchased in about 1980. Bill Hague says, "It is still completely accurate but rather large to carry around compared to modern instruments like the 2260. The Type 2231s which we bought in the early 1990s are in regular daily use and have proved to be an excellent investment."

Key Facts

- The University of Glamorgan became the county's second university in 1992
- The mechanical engineering department educates the engineers of the future, engages in research and provides consultancy services to companies
- The automotive and electronic industries are the major focus – strong relationships have been developed with automotive manufacturers and sub-suppliers
- The university has a wide range of Brüel & Kjær products – analyzers, sound level meters, transducers, etc.
- Portable PULSE™ with a 4+1 channel front-end has been purchased
- The university says that Brüel & Kjær provides excellent service, support and training
- Brüel & Kjær products give complete confidence to the university and its customers

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