

Mechanical & Automotive Engineering at the University of Bradford.

Automotive Engineering has a long history in the Bradford area of West Yorkshire. Exactly 100 years ago in 1910 the first Jowett car was sold, having been designed and built in Bradford. Although the Jowett car company has long since gone, the School of Engineering, Design, & Technology is privileged to have Benjamin Jowett Memorial Scholarships which are awarded by members of the Jowett family every year to high-performing students on its Mechanical, Automotive and Design courses. Benjamin Jowett, together with his brother William, founded the Jowett Motor Manufacturing Company in 1904. Also among the Bradford region automotive heritage are Scott motorcycles and Panther motorcycles, and very well-known component manufacturers including Hepworth and Grandage (pistons) and Mintex (brake linings).



The teaching of automotive engineering at the School of Engineering, Design and Technology first began as part of the IMechE accredited Mechanical Engineering course in 1987. This was followed over the next few years with specialist teaching in areas such as of Engine and Powertrain, Chassis Engineering, and Automotive Manufacture. Finally in 1998 this culminated in the introduction of a dedicated 'Mechanical and Automotive Engineering' Automotive BEng course, by which time research in Automotive Engineering was very well established.

In 1994 the MSc programme in Engineering Quality Improvement (EQI) was started as a partnership with Ford of Europe to increase the understanding and ability of selected members of its engineering staff in Quality Engineering. In 1995 Ford sponsored the first sponsored Professorship in Engineering at the University of Bradford, the Ford Professor of Quality Engineering. Since 1994, over 120 Ford engineers, from all over the world, have gained Bradford MSc degrees which have underpinned their subsequent senior careers in the Industry.

Research and knowledge transfer projects funded by automotive companies over the last 20 years include commercial vehicle brake design, engine management – mapping and calibration, accelerator pedal design, design and manufacturing process improvement, statistical engineering, and vehicle design for safety. The long standing Braking of Road Vehicles short course for industry professionals runs annually, and short courses / seminars in Failure Mode Avoidance are popular. Current projects include a knowledge transfer partnership with Tata Motors European Technical Centre on regenerative braking, a CASE PhD studentship with Jaguar Land Rover on engine emissions optimisation, and a prestigious partnership with Cummins Turbo Technologies on advanced turbocharger design. The Research and Knowledge Transfer Centre's recent investment in hardware and facilities has supported and enabled all of these projects.

The University established the Research and Knowledge Transfer Centre in Automotive Engineering as one of the School of Engineering, Design, & Technology's areas of research in Mechanical Engineering in January 2010 to bring together staff knowledge, expertise and experience over a broad range of automotive-related topics. The Centre's research and knowledge transfer is supported by the School of Engineering, Design, & Technology, and this year we have completed an extensive investment programme to provide a unique set of world class experimental and analytical hardware and facilities for automotive engineering research including Quality, Design, Modelling, Simulation, and Manufacturing.

The Hybrid and Powertrain Engineering Research Centre (HyPER-C) was started in 2006. It provides state-of-the-art experimental and simulation facilities in a laboratory with two computer controlled regenerative dynamometers one of which is unique (in the UK) being for large engines up to 500kW, Hardware-in-Loop with powertrain modelling, 'Rolling Road' regenerative dynamometer, brake and friction test rigs, mechanical power transmission (belts) test rigs, and in-vehicle instrumentation and datalogging equipment with GPS for on-road vehicle and driver evaluation.



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www.hyperc.co.uk



The HyPER-C Director, Professor Kambiz Ebrahimi, is an international expert on dynamic modelling and control of drivelines and powertrains, especially internal combustion engine control, modelling and simulation. He is currently leading the Advanced Turbocharger Engineering project (ATTEP) in partnership with Cummins Turbo Technologies in the HyPER-C laboratory within the Research and Knowledge Transfer Centre in Automotive Engineering. He has worked extensively with Ford on research in engine mapping and calibration, system identification and dynamic condition monitoring, and is also leading a Knowledge Transfer

Partnership with Powell Engineering on model based condition monitoring.

The Bradford Engineering Quality Improvement Centre (BEQIC) was started in 1994 with sponsorship from Ford. The BEQIC Director, Dr. Felician Campean, is a leading authority in 'Failure Mode Avoidance'; a methodology which is applied to design and manufacturing processes in the Automotive Industry to ensure highest consistency and customer focussed quality in the product. A set of Knowledge Transfer Partnerships with British Aerospace will start in July 2010 which will transfer knowledge gained from the Automotive industry to Aerospace high volume manufacture.

<http://www.eng.brad.ac.uk/eqi/>

The Research and Knowledge Transfer Centre in Automotive Engineering is staffed by members of the School's academic staff and research and technical staff funded through its project work. We are aided in our work by colleagues in Industry who work closely with us as visiting Research Fellows, including Dr. John Allport (Cummins Turbo Technologies) and Professor Tony Martyr (ex-AVL) who have both contributed their knowledge and expertise to ensure that our engine dynamometer facilities represent state-of-the-art in every respect.

It is very important that expertise and knowledge built up in our core business of education and training is maintained, and the Centre has an excellent track record of both employing graduate students and finding employment in Automotive companies. Dr. Yahia Abdel-Fattah, who completed his PhD in 2009 now works at Meritor Heavy Duty Braking Systems in brake design and analysis. Dr. Benjamin Ho (PhD 2009) works at Jaguar Land Rover as CAE Engineer in Brake Systems. Dr. Byron Mason and Dr. Antonios Pezouvanis, who completed their PhD's in 2008 and 2009 both now work in the University.

Dr. Byron Mason is Lecturer in Automotive Engineering whose duties include lecturing and researching into Thermodynamics, Engine and Powertrain and Engine Mapping and Calibration. Byron came to the University of Bradford as an undergraduate student in Mechanical Engineering in 2002 and having graduated with a BEng Degree in 2005, continued his studies for a PhD sponsored by Ford into model based powertrain development.

"My time spent as an undergraduate and then postgraduate student at the School of Engineering, Design and Technology in the University really helped me to understand how to apply knowledge that I learned through my studies to practical engineering situations. This coupled with the excellent facilities available for automotive research encouraged my interests in product development through the use of modern

dynamic simulation techniques applied to the automotive technologies. I am now involved almost daily with major automotive OEMs and their suppliers assisting them in finding engineering solutions and conducting research to advance 'state-of-the-art' automotive technology. My special interests are the use of models coupled with real hardware to enable rapid, reduced-cost prototyping and advanced product testing for development, an increasingly important area of research due to the complexity of modern automotive systems."



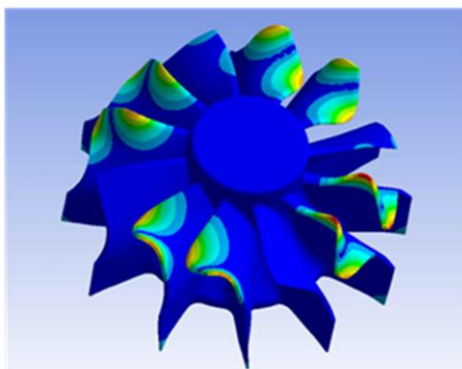
Dr. Antonios Pezouvanis is Post-Doctoral Research Assistant in Powertrain Engineering whose duties include researching into engine and powertrain design, analysis and performance, together with the technical management of the Hyper-C facilities and equipment. Antonios came to the University of Bradford as an undergraduate student in Mechanical Engineering in 2001 to study Mechanical and Automotive Engineering, and having graduated with a BEng Degree in 2004, continued his studies for a PhD sponsored by EPSRC and Ford Motor Company into Engine Modelling for Virtual Mapping. Antonios has significant experience of engine computer control, ECU calibration and much practical experience of engine optimisation and enhancement. This high-level expertise in automotive systems is essential for the fulfilment of his role in our modern automotive laboratory that includes three advanced computer-controlled dynamometer systems.



"My studies at the University of Bradford provided me with the underpinning theoretical knowledge that I have now successfully combined with my practical skills and experience. This has equipped me for my role in HyPER-C and helps me to solve the engineering problems that I face on a daily basis such as design and installation of the University's new automotive testing facilities. My passion has always been mechanical engineering with a focus on automotive systems and HyPER-C provides me with a variety of challenges as we work in partnership with companies and other Universities to

advance modern automotive technologies. My research interests are innovative engine and powertrain design, engine mapping and calibration, mathematical modelling and dynamic simulation."

The HyPER-C laboratory in the Research and Knowledge Transfer Centre in Automotive Engineering will be formally opened on 26 May 2010 when the Advanced Turbocharger Technology Engineering Project sponsored by Cummins Turbo Technologies with Yorkshire Forward is formally launched by Jim Lyons, the Chief Executive Officer of Cummins Turbo Technologies. The Advanced Turbocharger Technology Engineering Project has involved the installation of the 500kW computer-controlled regenerative engine test dynamometer with an associated high capacity electrical supply to create a state-of-the-art research facility. Using the 13-litre diesel engine installed on this test facility, we are studying the performance of high speed turbochargers to be used for achieving the next generation of European emissions standards. Highly sophisticated laser-based instrumentation is utilised to prove out predictions from computer simulation which will ultimately be used by Cummins Turbo Technologies to enhance its design procedures.



Dynamic response of turbocharger rotor blades



There are opportunities for students who want to work with us in the Research and Knowledge Transfer Centre in Automotive Engineering towards a PhD. At present we have around 10 research students working on research projects ranging from engine cycle-by-cycle mapping, regenerative braking, engine calibration optimisation for emissions reduction, turbocharger sensor technology, and vehicle dynamics modelling.

For further information on the Research and Knowledge Transfer Centre in Automotive Engineering and any of the topics described here please contact the Director, Professor Andrew Day, +44 1274 234522, email a.j.day@bradford.ac.uk