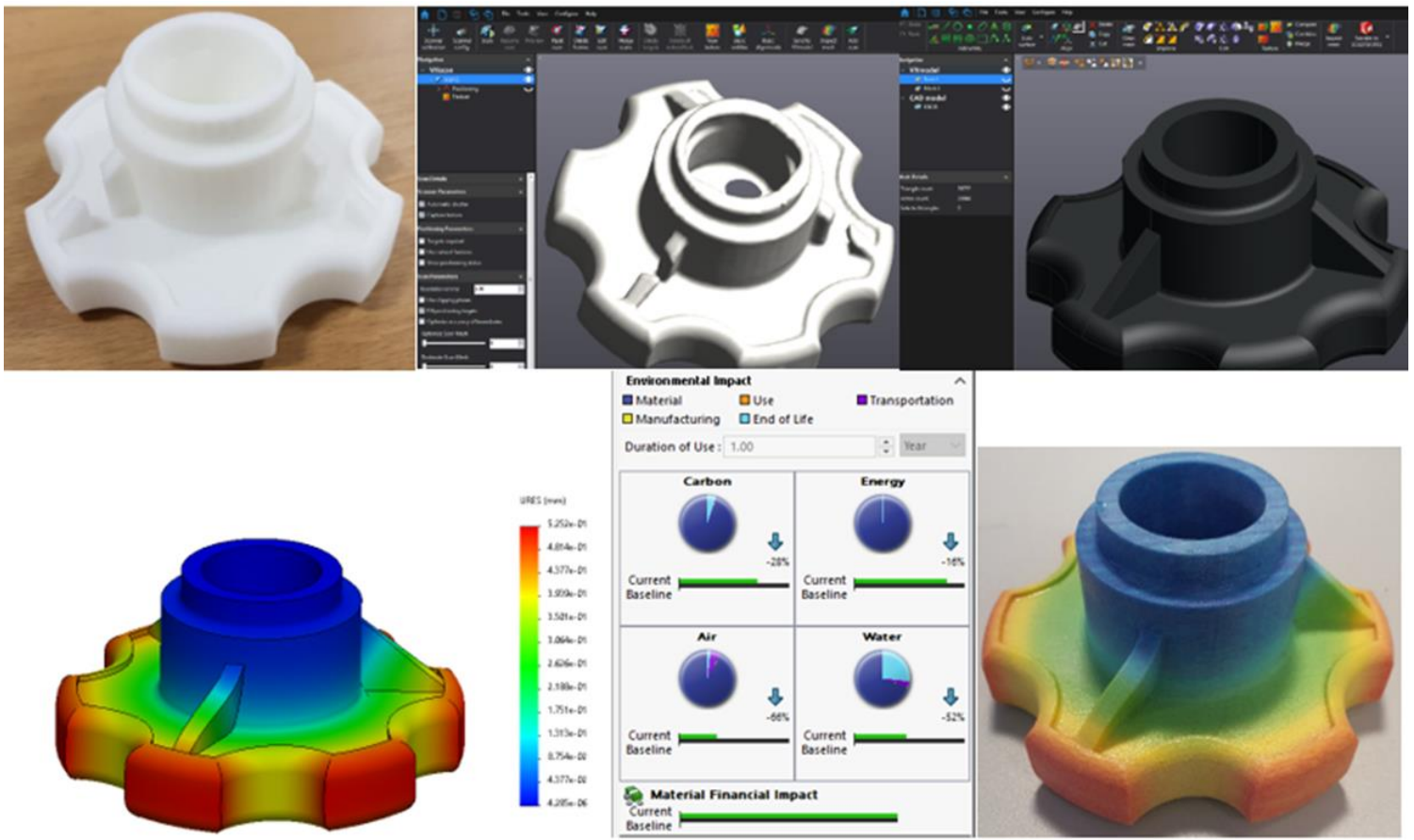


ENGINEERING DESIGN AND MANUFACTURE (EDM) RESEARCH GROUP NEWSLETTER 1 (April 2022)



[image: Fayyaz Rehman, "Scan to Optimised and Sustainable Design Workflow of a component"]



[image: Title Image of "Advances in Manufacturing Technology XXVIII", 2014 Edited by Fayyaz Rehman, Nicholas Woodfine and Ramesh Marasini]

INTRODUCING THE ENGINEERING DESIGN AND MANUFACTURE (EDM) RESEARCH GROUP

Since Engineering Design and Manufacture are the two most important stages of product life cycle in terms of crucial decision making regarding its design/form/shape, material selection/sustainability, manufacturing, operation/use and recycling/disposal of product and end of life cycle, therefore an integrated concurrent design and manufacture approach is now new state of the art practise currently employed in the industry. Due to the recent advancements in design (simulation/virtual reality/digital twinning), materials (smart/composite/3D printed materials) and manufacturing (additive/hybrid/robotics/automation), there is great scope now to research, design, manufacture and evaluate new sustainable products and systems in different fields of engineering. Therefore, *Engineering Design and Manufacture* (EDM) research group is formulated to bring together researchers from various (Mechanical, Electronics, Yacht Design and Renewable Energy) fields of engineering group here at Solent University to research into the development of products using latest advancements in design, materials, and manufacturing technologies.

The EDM research group will consolidate each member's individual research towards a joint research approach with well-defined focus areas in Engineering, as well as plan collectively for interdisciplinary research and externally funded research projects as a research group to gain a critical mass and volume of research output leading to more peer-reviewed publications and impact case studies being generated for the REF2027 submission. Some research group members are already using their research to inform their teaching in the form of case study examples and new lab equipment/components designed and manufactured as research results. It is envisaged that by formalising an Engineering Design and Manufacture (EDM) research group will enable a wider insight and a more solid approach for integrating research into our practical and theoretical teaching to the benefit of students and improvement of course reputations alike.

KEY THEMES /QUESTIONS EXPLORED BY GROUP:

The EDM research group members intend work on following areas of key themes of engineering design and manufacture:

- Engineering Simulation and Testing,
- Additive Manufacturing Materials Design and Characterisation,
- Composites Design and Manufacture,
- Non-Destructive Testing (NDT) and Imaging,
- Renewable Energy Infrastructure and Processes design,
- Sustainability Engineering,
- Acoustics Modelling and Characterisation,
- Wireless Systems and Networking Domains,
- Computational Engineering algorithms,
- Multi-physics Modelling and Simulation,
- Automated Sensing and Analysis of Data Sets.

CURRENT RESEARCH

Exploratory Use of Additively Manufactured Component for Fluid Mechanics: Dr. Fayyaz Rehman and Mr. Rob Benham

The university has a range of fluid mechanics experiments where standard few experimental components with limited designs made up of different alloy materials are currently available for use within these experiments. Lead time and cost for getting additional components from suppliers is quite high. Besides design variation is also quite limited for components from these suppliers. We are currently exploring the use of additive manufacturing technology to design and build optimised parts with variety of design/shapes for these experiments. The results are quite promising as additively manufactured components' design freedom is unlimited as well as build time and cost is much less than purchasing these components from suppliers.



("An Investigation into the Exploratory Use of Additively Manufactured Vanes Subjected to the Impact of a Water Jet Experiment", Benham, R. & Rehman, F. in *Advances in Manufacturing Technology* XXXIII, 2019)

Impacts of technology on environment: Dr. Parakram Pyakurel

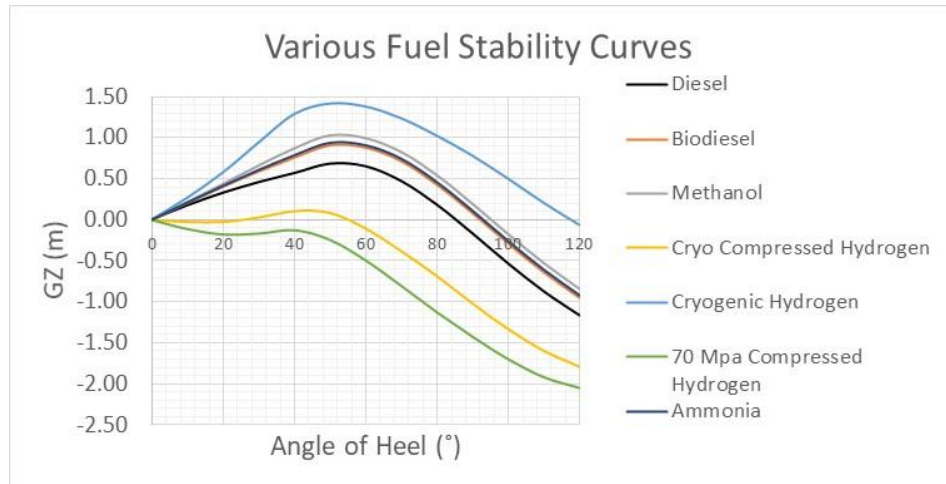
Parakram is exploring the roles and impacts of technology on environment and some of the findings of his research has been published in the *Journal Economics and Policy of Energy and the Environment*. His research aims to contribute towards advancing the growth versus degrowth debate by evaluating the potential of technology in solving existing ecological and social crises. Parakram is also working on the area of hydrogen economy where he investigates approaches to improve the supply chain management of hydrogen fuel for marine applications.



Implementation of Ship Hybridisation: Dr. Vittorio Boccolini

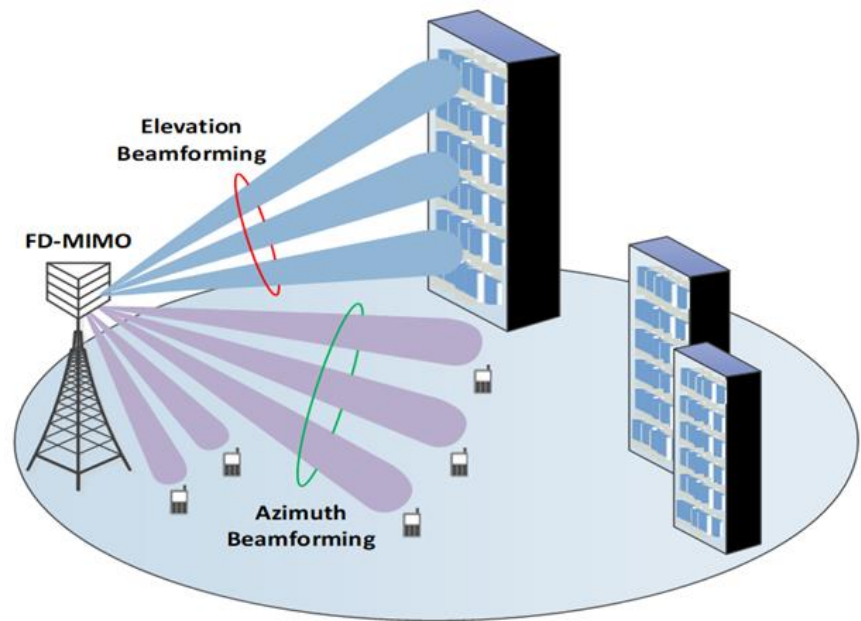
The aim of the project is to test and validate several technical tools and business models for the implementation of hybrid and hydrogen fuel cell technologies in ships and ports.

Vittorio is working on enhancing mechanical properties of marine composite and, more recently in the use of natural fibres and bio-resins for marine composites investigating their mechanical properties and potential application.



Exploring Analogue Beamforming for Very Large Antenna Array: Dr. Sinan Khwandah

The aim of this project is to take full advantages of Massive MIMO technology and to overcome the challenges of its implementation in a real environment. Massive MIMO allows for 3D beamforming to provide more degrees of freedom and increase the number of high-throughput users. Beamforming is promising technology due to much less wasted power in the coverage area and mitigating propagation loss. This results in less interference and increases the spectral efficiency when using spatial multiplexing. Current research is based on exploring analogue beamforming for very large antenna array, e.g., beam switching and sweeping, this will be proceeded with hybrid analogue/digital beamforming for massive MIMO.

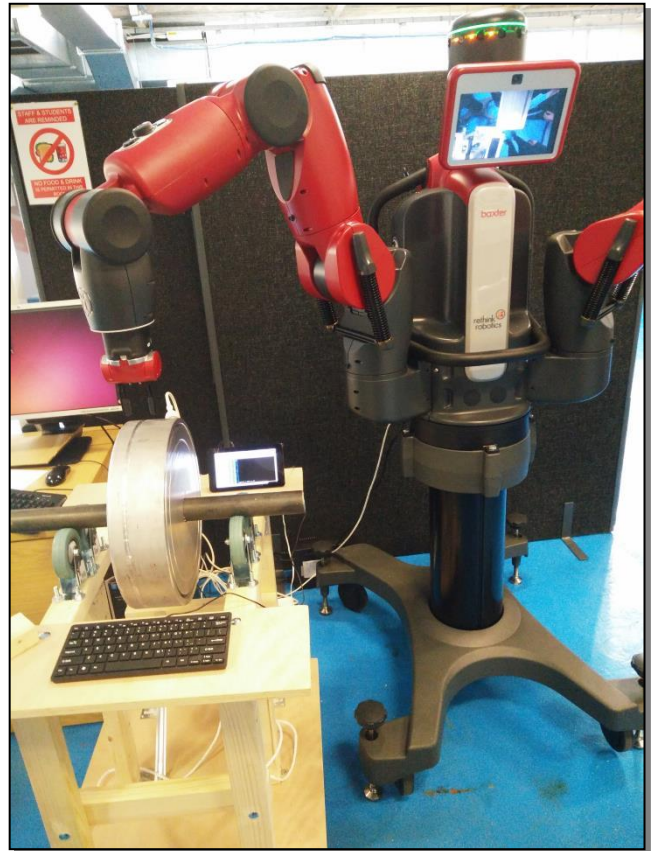


Non-destructive testing methods in railway wheel maintenance: Dr. Marc Molinari

A feasibility study was funded by the railway safety and standards board (RSSB) to investigate the possibility of finding new automated methods for the efficient inspection of railway wheel sets. Railway carriage wheels are in demanding use over long distances and periods of time and require regular inspection for visible external and invisible internal faults that may develop during their use.

Part of our research investigated new methods for inspection which led to a patent for a new method of combining ultrasound, geometry, sub-surface, and surface detection sensors together with a new algorithm to enable this with current technologies in automation and sensor technologies.

Robot-supported automated scanning of wheel defects
(RSSB-funded non-destructive testing study, M. Molinari 2017)



CURRENT MEMBERS

The EDM research group has currently 9 members and have existing research strengths in the areas of Mechanical Engineering, Renewable Energy Engineering, Electronics Engineering and Yacht Engineering. The group members regularly present and publish their research at international conferences and in peer reviewed journals and have carried out internal and external, nationally, and internationally funded Engineering design and manufacture related research projects. Some group members are also active in newly developed Centre for Marine Sustainability and have a track record in knowledge exchange through Knowledge Transfer Partnership (KTP) projects and industry-body funded research that resulted in a patent as well.

Dr Fayyaz Rehman

Dr. Fayyaz Rehman is currently working as Associate Professor (Engineering Design) and Knowledge Exchange (KE) strategic lead at Faculty of Creative Industries, Architecture and Engineering (FCIAE). Fayyaz has over 20 years' experience of teaching and research in the fields of engineering design and manufacture, both in UK and in overseas. Fayyaz has done research in the areas of Design for X (Functionality, Assembly/Manufacturability) methodologies, material characterisation, CAD/Engineering Simulation and application of additive manufacturing/3D printing technologies. He has peer reviewed publications comprising of international conferences, books, workshops, and journal papers. He is also a vice chair and committee member of the Consortium of UK Manufacturing Engineering Heads (COMEH), a UK Higher Education Institutions based body responsible for promoting manufacturing engineering education and research, as well as organising the International Conference on Manufacturing Research (ICMR) conference series annually.

Dr Marc Molinari

Dr. Marc Molinari is course leader for the Electronic Engineering and Renewable Energy Engineering courses and a senior lecturer in the Faculty of Creative Industries, Architecture and Engineering (FCIAE). He teaches analogue and digital electronics, embedded systems including Arduino, FPGA and robot programming, and electronic circuit design as well as digital signal processing.

Marc has performed research in the areas of tomographic image reconstruction, automation and control, non-destructive testing, design optimisation, wireless systems, and networking domains through externally funded research projects. His research interests lie particularly in the use and integration of distributed sensor technologies, computational science and engineering solutions, data recording, security and analysis, microprocessor programming, applications, 3D printing and manufacturing and electronic and software design and implementation.

Mr. Robert Benham

Mr. Rob Benham is a Senior Lecturer (Mechanical Engineering) and a course leader for the HNC Engineering and Foundation Year Engineering at Faculty of Creative Industries, Architecture and Engineering (FCIAE). He has strong research interests in manufacturing and materials. Rob's primary research is in applications and properties of additive manufacturing (AM) materials. Over the past few years Rob has produced a range of papers, investigating properties of AM polymeric materials as well as some applications in the applied mechanics laboratory. He is keen to incorporate his research into teaching and use new equipment to enhance the student learning experience, as well as support his continued desire to develop his research goals.

Dr. Parakram Pyakurel

Dr. Parakram Pyakurel is a Lecturer (Renewable Energy Engineering) at Faculty of Creative Industries, Architecture and Engineering (FCIAE). Parakram's primary research is in sustainability where he explores complex interactions among energy, environment, and society. His recent research topics include impacts of technology on sustainability, energy and resources cooperation, hydrogen economy and renewable energy systems such as ocean current turbines. Parakram's research interests are sustainable infrastructure design, renewable energy systems, hydrogen economy, energy and resources planning, hydrodynamics

Dr. Vittorio Boccolini

Dr. Vittorio Boccolini is a Senior Lecturer (Yacht Engineering) at Faculty of Creative Industries, Architecture and Engineering (FCIAE). His background is in structural design and composite materials. He has also worked with some students to develop innovative and challenging dissertations and some of them were the base for some published papers. In the area on naval architecture, Vittorio wants to investigate the effect of air insufflation to reduce the resistance of some traditional hull form.

Mr. Jonathan Ridley

Mr. Jonathan Ridley is an Associate Professor (Engineering Education) and Head of Engineering at Faculty of Creative Industries, Architecture and Engineering (FCIAE). His background is in experimental and computational fluid hydrodynamics ranging from CFD application and validation and consultancy to scale model and towing tank testing. Jonathan has industrial experience of experimental and computational fluid dynamics. He also has experience of providing professional assessment and marking to industry bodies to assess practical competence and technical knowledge. In addition, he has experience of designing and delivering short professional and technical courses to international industry. Jonathan's research interests include theoretical and experimental hydrodynamics, teaching and learning.

Dr. Puja Mishra

Dr. Puja Mishra is a Lecturer (Electronic Engineering) at Faculty of Creative Industries, Architecture and Engineering (FCIAE). Puja's research interests are based on machine intelligence, healthcare technology and internet of things. She also works on gender and racial diversity, aiming to close gaps and diversify talent in STEM courses, and particularly in engineering.

Mr. Simon Saggars

Mr. Simon Saggars is a Senior Lecturer (Electronic Engineering) at Faculty of Creative Industries, Architecture and Engineering (FCIAE). Simon has worked as research and development engineer, working within the field of industrial computer-based automation and control systems, collaborating with industrial partners in the military, medical, transport, oil and gas, and scientific research sectors. His research interests are multi-physics modelling and simulation and automated sensing and analysis of data sets.

Dr. Sinan Khwandah

Dr. Sinan Khwandah is a Lecturer (Renewable Energy and Electronics Engineering) at Faculty of Creative Industries, Architecture and Engineering (FCIAE). His research has been focused on communication and networks. His latest research is concerned with cellular networks including radio planning and system optimisation, management of heterogeneous networks, MIMO, and network architecture. He has contributed to several international conferences, is involved with improving science writing and editing and is active in peer reviewing high-quality publications for several international publishers such as IEEE and Springer.

Thank you for reading!

To join EDM research group or for updates, please
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