Sheffield Hallam University | Materials and Engineering Research Institute

FESTIVAL OF INNOVATION 2021

MERI Research Symposium Programme 2021

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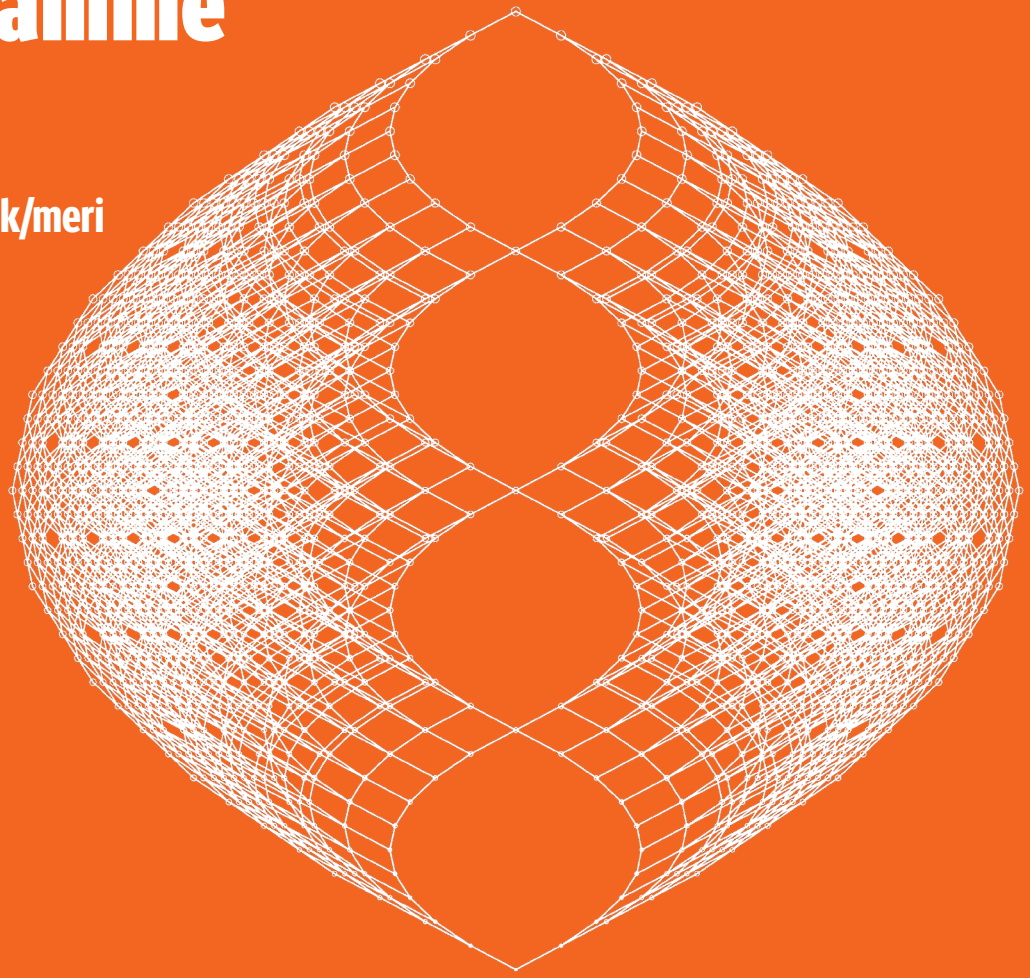
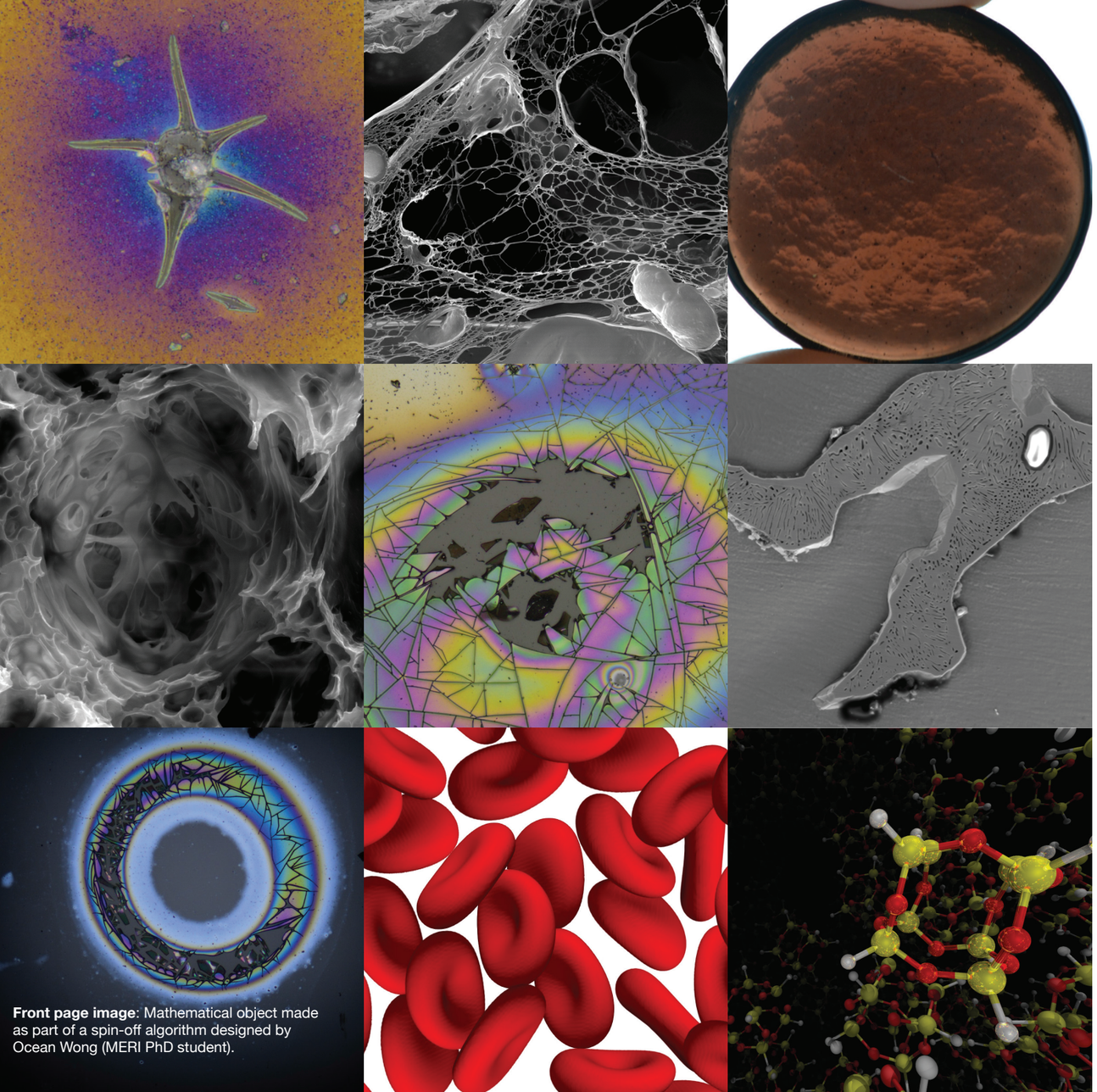




Front page image: Mathematical object made as part of a spin-off algorithm designed by Ocean Wong (MERI PhD student).

Welcome

It is with great pleasure that I welcome you to the 10th annual *Materials and Engineering Research Institute (MERI) Symposium*. This year our Symposium is a key event in the Festival of Innovation and we have opened up the Symposium to an external audience for the first time - so an especially warm welcome to friends, colleagues and new acquaintances from outside the University. I am confident you will find a vibrant programme and look forward to fruitful discussions during and following the event.

As a consequence of the cancellation of last year's event due to the pandemic, we have an especially strong and packed programme of oral and poster presentations this year, showcasing the diverse range of highly collaborative and multidisciplinary research undertaken by our talented staff and students within MERI, within the Department of Engineering and Mathematics, across the University and with external partners. You will see and hear how we are addressing genuine real-world issues of significance to enable MERI to deliver on the development needs of industries that rely upon materials and engineering. In doing this, our work promotes healthy, independent living and is developing technology platforms underpinning and enabling the economies of the future.

This year's inaugural Professorial lecture will be delivered by Antonio Feteira, Professor of Advanced Functional Materials. Explaining the importance of ceramics in the modern world, particularly in the field of electronic ceramics, Antonio will ask *What have ceramics ever done for us*?

As is customary, panels will judge the student poster and oral presentations and we will be presenting the Chris Breen memorial prize for the best student presentation.

On behalf of the MERI Symposium Organising Committee, I thank all contributors for their time in preparing, delivering and discussing the presentations of their recent work and wish you all an enjoyable and stimulating Symposium.

Professor Andrew Alderson
Director, Materials and Engineering Research Institute

Sheffield Hallam University | Materials and Engineering Research Institute

DAY 1 – TUESDAY, 08 JUNE 2021

Time	Category	Event	Title – Session 1	Speaker– Session 1	Title – Session 2	Speaker– Session 2
09:50		Welcome	Welcome	Prof Andy Alderson	Welcome	Prof Andy Alderson
Session 1 – Chair: Prof Andy Alderson						
10:00	Staff talk	Talk 1	Multi-disease diagnosis with a heart health monitoring service platform	Ningrong Lei		
Chair of parallel session: Dr Francis Clegg						
10:20		Talk 2	Molecular Dynamics Simulation of Organically Functionalised Nanoparticles Applicable to Polymer Nanocomposite Systems	Jacob Earnshaw (3)	Ultrasonic thermometer for measuring aggregate temperatures in dwellings.	Ali Elyounsi (2)
10:40		Talk 3	A transparent approach to modelling RBCs using chromodynamic lattice Boltzmann method	James Spendlove (3)	Development of a safe Human and Robot interaction and coordination model	Mohammed Rezwan Rahman (2)
11:00		Talk 4	Design and Development of Liquid-Cooled Rack Cabinets in Data Centres	Ramamoorthy Sethuramalingam (3)	Distributed Robot Swarm Formation	Jiacheng Chen (2)
Session 2 – Chair: Prof Fin O'Flaherty						
11:40	Staff talk	Talk 5	Numerical derivation of nonlinear contact laws for simulating compaction of granular assemblies	Ben Edmans		
Chair of parallel session: Dr Xu Xu						
12:00		Talk 6	Investigation into the influence of Friction Stir Welding in thick section aluminium alloys	George Henry Brooks (3)	Neutron spectrum unfolding: algorithm and system design	Ocean Wong (2)
12:20		Talk 7	Laser Beam Direct Energy Deposition – Effect of Process Parameters on Metallurgical and Mechanical Properties	Helen Elkington (3)	Emission Control from Thermal Treatment of Radioactive Waste	Alex Stone (2)
12:40		Talk 8	Elevator pitch for posters - 1 minute each either live or via video - 16 posters			
13:00	Lunch & Poster Viewing Session (Posters 1 - 7)					

DAY 1 – TUESDAY, 08 JUNE 2021

Time	Category	Event	Title – Session 1	Speaker– Session 1	Title – Session 2	Speaker– Session 2
Session 3 – Chair: Dr David Asquith						
14:20	Staff talk	Talk 9	Differential games applied to autonomous vehicle guidance in the presence of bearings-only measurements	Simone Battistini		
Session 3 – Chair: Dr Sima Aminorroya Yamini						
14:40		Talk 10	New Approach To Perform Plasma Nitriding Of Alloys Using HIPIMS Discharge	Krishnanand Shukla (3)	Can pre-course anxiety & attitudes predict grade?	Ellen Marshall (2)
15:00		Talk 11	A Smart Sleep Apnoea Detection Service	Ragab Barika (3)	Investigation of erosion-corrosion performance of Tantalum (Ta) -Tungsten (W) material.	Jitendra Singh Chouhan (2)
15:20		Talk 12	Tracking and Balancing Control of the LEGO Two-Wheel Robot with Extended Kalman Filter	Surapong Kokkrathoke (3)		
15:40 – 16:00	Break until Professorial Lecture					
16:00 – 16:05	Introduction of Inagural Professorial lecture by Prof Andy Alderson					
16:05	Inaugural Professorial Lecture (places must be booked for this event)					
17:05	Final words/thanks to Antonio from Prof Andy Alderson					
17:10	Networking with BYO Wine and nibbles					
18:00	Close					

DAY 2 – WEDNESDAY, 09 JUNE 2021

Time	Category	Event	Title – Session 1	Speaker– Session 1	Title – Session 2	Speaker– Session 2
09:50		Welcome	Welcome	Prof Andy Alderson		
Session 4 – Chair: Prof Andy Alderson						
10:00	Staff talk	Talk 1	Exploring Bioleaching for the Sustainable E-waste Disposal	Mukesh Goel		
10:20		Talk 2	Bentonite-Chitosan composites or beads for heavy metal adsorption: design, preparation, and characterisation	Hassan Majiya (3)		
10:40		Talk 3	Phase separation in sodium borosilicate glasses doped with phosphorus pentoxide	Katrina Love (3)		
11:00		Talk 4	Structural changes in borosilicate glasses with varying Fe2O3 contents – a multi-spectroscopic approach	James Eales (3)		
11:20	Break					
Session 5 – Chair: Prof Chris Sammon						
11:40	Staff talk	Talk 5	Flying by the Sun: Development and future outlook of Solar-Powered Multi-rotor UAVs	Stephen Agha		
12:00		Talk 6	Foaming behaviour during vitrification of high-iron nuclear wastes: Alternative reductants	Jessica Rigby (3)		
12:20		Talk 7	The characterisation, development, and optimisation of peracid-based disinfectant formulations for infection control	James Derham (3)		
12:40		Talk 8	Influence of Pre-Wetting on the Nanolime performance for the Consolidation of Limestone Museum Objects	Cyril Maucourant (3)		

DAY 2 – WEDNESDAY, 09 JUNE 2021

Time	Category	Event	Title – Session 1	Speaker– Session 1	Title – Session 2	Speaker– Session 2
13:00	Lunch & Poster Viewing Session (Posters 8 - 14)					
Session 6 – Chair: Dr Emma Martin, Associate Dean Research & Innovation						
14.30	Close of event and prizes					
15:00	End of event					

Ningrong Lei (staff speaker)
Senior Lecturer in Systems Engineering
Department of Engineering & Mathematics

Multi-disease diagnosis with a heart health monitoring service platform

There is a great medical and economic need to support diagnosis of multi-disease, like cardiovascular disease, Atrial Fibrillation (AF), diabetes, and sleep disorders. To address this need, we put forward the idea that the combination of heart rate measurements, Internet of things, and advanced Artificial Intelligence (AI), forms a Heart Health Monitoring Service Platform (HHMSP). This service platform can be used for multi-disease monitoring, where a distinct service meets the needs of patients having a specific disease. The service functionality is realized by combining common and distinct modules. This forms the technological basis which facilitates a hybrid diagnosis process where machines and practitioners work cooperatively to improve outcomes for patients.

Having common modules allows us to harvest the economies of scale. Distinct modules define which AI models are used and how the communication with physicians and patients is handled. That makes the proposed HHMSP agile enough to address safety, reliability, and functionality needs from healthcare providers.

In this talk, I will showcase the practicality of the service platform using a real time AF detection service for stroke prevention.

Mini Profile

Dr Ningrong Lei is a senior lecturer in systems engineering and course leader of MSc Advanced Engineering and Management. Ningrong gained her PhD from Nanyang Technological University, Singapore. Her main research interests are data driven modular product and service design. Her current research focuses on developing a heart health monitoring service platform. She is passionate to translate this big data enabled service innovation into a commercially successful service which benefits patients and the wider society.

Jacob Kristian Earnshaw
Prof. Doug Cleaver
Polymers Nanocomposites & Modelling

Molecular Dynamics Simulation of Organically Functionalised Nanoparticles Applicable to Polymer Nanocomposite Systems

Organically functionalised polyhedral oligomeric silsesquioxanes (POSS) are nanoparticles which offer a fascinating combination of organic and inorganic behaviours. POSS systems can exhibit a wide range of behaviours through variation of the geometry of their central inorganic cores and the choice of functional ligands. This makes them ideal candidates for achieving numerous thermomechanical, optical and barrier properties.

Here, we use molecular simulation to systematically examine POSS cubes with a range of ligands. From this, we identify the key molecular degrees of freedom which freeze in at glass transition (Tg) temperatures, thereby providing insight for synthetic control of this property. We also present steps towards more ambitious systems of functionalised POSS cubes incorporated into polymeric matrices.

Mini Profile

Graduated from Sheffield Hallam University with a degree in Chemistry. Originally from Huddersfield.

Ali Elyounsi
Supervisor: Dr Alexander Kalashnikov
Centre for Automation & Robotics

Ultrasonic thermometer for measuring aggregate temperatures in dwellings

Temperature sensors are ubiquitous to science, medicine, industry and our daily lives. Conventional sensors feature undesirable time lag and respond to temperature changes at a single localised point. Contrary to that, ultrasonic temperature sensors allow for responsive estimates and the temperature is sensed across the whole ultrasonic pathway. Ultrasonic Oscillating Temperature Sensors (UOTS) produce sustained oscillations at a frequency that relates to the temperature of the medium between the transducers.

This research aims to develop UOTS operating in air at the distances of several meters, which will allow assessing aggregate temperature in dwellings (human habitable buildings) using a single sensor.

Mini Profile

Mature student with keen interest in science and technology

James Spendlove
Supervisor: Dr Xu X
Polymers Nanocomposites & Modelling

A transparent approach to modelling RBCs using chromodynamic lattice Boltzmann method

The accurate modelling of fluid-filled vesicles, such as Red Blood Cells (RBC), has obvious relevance in biomedical science.

Current methodologies either focus on the simulation of single RBCs with great accuracy, on scalability to dense suspensions with fading accuracy, or are encapsulated in complex, multi-framework approaches.

Presented here is a novel, three-dimensional, single framework, chromodynamic multi-component lattice Boltzmann method for simulating vesicle hydrodynamics.

Which is:

(i) Transparent – encapsulated in a single framework methodology.

(ii) Robust - accurate and stable far from mechanical equilibrium.

(iii) Scalable - can be extended to many vesicles.

Applicable, complex geometries and relevant scales can be simulated.

Mini Profile

3rd year PhD student with academic interests in the mathematical modelling of fluids and mesoscale modelling approaches with biomedical applications. My interests include travelling, film photography, farming and music.

Mohammed Rezwan Rahman

Supervisor: Prof. Alessandro Di Nuovo
Centre for Automation & Robotic

Development of a safe Human and Robot interaction and coordination model

Application of co-working robots safely and comfortably in the daily process flow requires not only technical safety but also a level of comfort for the human worker. This study mostly focuses on how the working space of a collaborative robot can be controlled in order to explore various safe and personified movements and make it suitable to work alongside a human co-worker.

Mini Profile

Rezwan has been awarded BEng (Electronic Engineering) and MSc (Advanced Engineering) from Sheffield Hallam University. He is now studying towards a PhD in Centre for Automation and Robotics Research (CARR), SHU, focusing on safe Human-Robot Collaboration.

Ramamoorthy Sethuramalingam

Supervisor: Dr Abhishek Asthana
Centre for Automation & Robotics

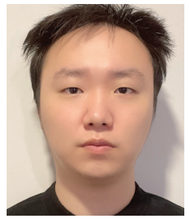
Design and Development of Liquid-Cooled Rack Cabinets in Data Centres

Data centres around the world consume enormous amount of electricity (more than that of the entire UK) and the consumption is growing exponentially, contributing to global warming. This electricity is eventually converted into heat which must be removed for safe operation of servers. The cooling of data centres is again energy intensive. Replacing the traditional air-cooled systems by water/liquid cooled systems offers an alternative approach with significant energy and cost savings advantages.

A prototype water-cooled rack cabinet and test rig are developed here, holding 40 kW servers with rear-door cooling. Results of experimental data from the test rig are presented on cooling performance, energy efficiency and cost savings.

Mini Profile

Born in India and graduated from Staffordshire University in Aeronautical engineering. Now took this incredibly exciting and empowering PhD opportunity in MERI/SHU as well as a KTP Associate at Orion to develop cutting edge server cooling technology.



Jiacheng Chen

Supervisor: Dr Lyuba Alboul
Centre for Automation & Robotics

Distributed Robot Swarm Formation

The research project focuses on the collective decision-making of swarm robots during their interaction. MATLAB and programming knowledge are used to simulate and test the system. The goal of recent experiments is to study e-puck robots and path planning algorithm in depth, also to precisely control robots by adjusting the onboard signal or voltage. I hope to meet researchers with the similar interests in this research symposium and will accept guidance with an open mind.

Mini Profile

Chinese-born overseas student who has been in Sheffield for 8 years.

Ben Edmans (Staff talk)

Lecturer in Mechanical Engineering
Solid Mechanics and Dynamics Subject Group, Department of Engineering & Mathematics

Numerical derivation of nonlinear contact laws for simulating compaction of granular assemblies

The production of solid forms by powder compaction is an important manufacturing pathway in the pharmaceutical and food industries. The mechanical strength of powder compacts depends on particle properties, particle surface properties and process parameters, and is understood to be mediated by characteristics of interparticle adhesive contact force networks, though design of compaction processes currently relies on empirical methods. Simulation approaches for granular materials typically idealize particles as rigid spheres or polygons and computing particle interactions using contact laws.

To adapt these techniques for compaction modelling, contact laws must be developed considering the volumetric straining capacity of the intraparticle material and more accurate estimates of contact force on unloading from large displacements.

In this presentation, I will describe parametric finite element studies used to establish contact laws incorporating these features. Laws will be expressed as functions of material properties while qualitative response will related to yielding behaviour.

Mini Profile

I recently joined SHU as a lecturer in Mechanical Engineering. My research interests involve the development of multiscale numerical methods to analyse systems and structures showing complexity over a range of length scales. Before joining SHU, I worked as a postdoc at Leicester University, where I contributed to the collaborative project “Virtual Formulation Laboratory”, which developed a suite of tools for predicting the behaviour of granular materials from particle-level properties. I have also been involved in research in offshore structural mechanics in academic and industrial roles (Brunel University, Lloyd’s Register Energy), specialising in unbonded flexible risers.

George Henry Brooks
Supervisor: Stephen Magowan
Structural Materials & Integrity

Investigation into the influence of Friction Stir Welding in thick section aluminium alloys

Friction stir welding (FSW) is a solid state joining technology with a wide range of applications. However, there is a limited pool of published knowledge relating to the process variants that make FSW of thick section materials possible.

The primary aim of this project is to investigate the influence of three FSW techniques on weld quality when joining a range of 50 mm thick aluminium alloys. Each has a different thermo-mechanical input and effect on the weld zone which has yet to be extensively investigated and quantified.

Mini Profile

Having studied Aerospace Engineering at SHU as a BEng, I transitioned to a PhD with TWI Ltd through my dissertation project. Spare time revolves around badminton, cricket and cycling.

Ocean Wong
Supervisor: Dr Robin Smith
Polymers Nanocomposites & Modelling

Neutron spectrum unfolding: algorithm and system design

Activation foil neutron spectrum unfolding is a necessary technique for monitoring the operation of future fusion reactors. This talk explains the basics of this technique and the issues it currently faces, including the lack of standardized algorithms and modern programs for unfolding, and the lack of a systematic method to select foils. An unfolding-suite containing various unfolding algorithms, and a foil selector tool that shows the effectiveness of each foil, were created to address these issues respectively.

Mini Profile

Passionate about nuclear fusion, neutron metrology and good software practice. Loves tackling hard problems.

Helen Elkington
Supervisor: Stephen Magowan
Structural Materials & Integrity

Laser Beam Direct Energy Deposition – Effect of Process Parameters on Metallurgical and Mechanical Properties

Laser Beam Direct Energy Deposition (DED-LB) is an Additive Manufacturing (AM) process. A laser is used as a heat source to create features or components from molten metal powder.

Numerous process parameters are involved in the DED-LB process - including laser power, scan speed and powder feed rate. Complex relationships exist between these process parameters, ultimately dictating the properties of the deposited material.

This work investigates certain process parameters involved in the DED-LB process, subjecting samples built using DED-LB to metallurgical and mechanical testing.

Mini Profile

When I'm not examining metal, I can usually be found running up hills in the Peak District.

Alex Stone
Supervisor: Prof. Paul Bingham
Centre for Automation and Robotics Research

Emission Control from Thermal Treatment of Radioactive Waste

This project aims to develop a real-time gas analysis system to collect data on the emissions of radionuclides and other pollutants from the vitrification of intermediate level radioactive wastes (ILWs). A test rig has been created to understand the evaporation mechanics of waste glass melts and a waste composition has been formulated to simulate ILW waste streams at UK nuclear sites.

These include SIXEP sand/clinoptilolite, sludge and plutonium contaminated material (PCM). To date, simulant glasses have been run with XRD, XRF and TG-MS and are soon to be trialled on the completed off-gas system.

Mini Profile

PhD student in the Materials and Engineering Research institute with a background in chemistry from the University of Huddersfield. Previously worked as field analyst to fulfil EA permits for industries and as a researcher in Frankfurt on corrosion of coatings on magnesium alloys.

Simone Battistini (Staff talk)
Senior Lecturer in Aerospace Engineering
Department of Engineering and Mathematics

Differential games applied to autonomous vehicle guidance in the presence of bearings-only measurements

Autonomous vehicles are nowadays employed in many contexts, from aerospace to terrestrial applications. The requirements placed on the design of autonomous vehicles request always more autonomy, more accuracy, and reduced costs. This often results in a simpler architecture, such as in the case of vehicles equipped with cameras providing bearings-measurements only. This poses a problem on the guidance strategies to be designed for path planning and trajectory tracking.

The differential games framework, together with adequate numerical methods including for example Machine Learning algorithms, can be exploited to derive a guidance law that takes into account the observability issues related to the insufficient number of measurements.

Mini Profile

Simone Battistini joined Sheffield Hallam University in 2019 as a Senior Lecturer in Aerospace Engineering. He holds a PhD in Aerospace Engineering (2013) and a MSc (2009) and a BSc (2006) in Control Engineering, all from Sapienza Università di Roma (Italy). Before joining SHU, he was as an associate professor at University of Brasilia, Brazil (2013-2018) and a GNC engineer at MBDA Italy (2018-19). He spent visiting periods at Technion, Israel (2012) and at the University of Vigo, Spain (2017). His research interests cover a range of themes in Aerospace and Control engineering, such as Guidance, Navigation, and Control (GNC) in aerospace applications (satellite missions, rockets, air-dropped platforms), and state estimation of nonlinear systems.

Krishnanand Shukla
Supervisor: Prof. Papken Hovsepian
Thin Films Research Centre

New Approach To Perform Plasma Nitriding Of Alloys Using HIPIMS Discharge

CoCrMo alloy, although an acceptable choice for metal-on-metal prosthetic implants, requires improvements in mechanical and tribological properties. In this work HIPIMS discharge has been utilized to perform low pressure plasma nitriding (HLPN). Various analytical techniques have been used to study microstructure, diffusion behaviour, mechanical and tribological properties as well as corrosion properties. Later, all results of HLPN were compared with commercial DC plasma nitrided specimens (DCPN).

Achieved properties combined with the significant reduction in process time make HLPN a powerful technique for production.

Mini Profile

Krishnanand Shukla is last year PhD student at National HIPIMS technology centre, MERI and working on Development of HIPIMS plasma nitriding process. He demonstrated that by utilising HIPIMS discharge surface alloying process can be increased by many times compared to the benchmarked DCPN.
Born in a small town of north Indian state, Utter Pradesh, India. Graduated from NFSU. Interested in exploring world and passionate about mountain biking, food and movies.

Jitendra Singh Chouhan
Supervisor: Dr Jana Buddhadev
Thin Films Research Centre

Investigation of erosion-corrosion performance of Tantalum (Ta) -Tungsten (W) material

In this study, erosion-corrosion response of pure tantalum and tantalum-tungsten clad material will be investigated using both laboratory experiments and analytical modelling techniques. The work is of interests to Rutherford Appleton Laboratory (RAL), particularly with extending the life of their ISIS Ta-W spallation source (target) that experiences erosion-corrosion damage due to a flow of cooling water.

The work is currently at an early stage, and has completed pilot erosion experiments on pure aluminium samples and a preliminary study on pure tantalum samples. The pilot experiment identified a suitable method for measuring wear scar volume loss using stylus profilometry. The preliminary erosion studies on tantalum revealed some interesting erosion damage mechanisms, which are significantly different from that observed for pure aluminium.

Mini Profile

I am Jitendra Singh Chouhan doing my Ph.D. in Materials Science and Engineering at MERI. I have over 9 years of teaching and administrative experience in the department of mechanical engineering across institutions in India. I have written 1 book, published 6 papers and 120 articles. I am married, blessed with little angel who is now 5 years old, and making best use of my time in Sheffield and Sheffield Hallam University.

Ragab Barika
Supervisor: Dr Oliver Faust
Centre for Automation & Robotics

Accurate detection of sleep apnea with long short-term memory network based on RR interval signals

Sleep apnea has become one of the most prevalent healthcare problems causing great concern during the last decades. Diagnosis and treatment monitoring are key elements when it comes to addressing this public health crisis. An effective and precise auto diagnosis method using ECG is required. We propose an approach using Long Short-Term Memory (LSTM) network to detect apnea based on beat-to-beat interval signals.

Mini Profile

I am a full time PhD student, I was awarded a MSc in Advanced Engineering at Sheffield Hallam University in 2017. I enjoy working as part of a team. The research focuses on to detect sleep apnea based on RR intervals.

Ellen Marshall

Supervisor: Dr Peter Rowlett
Polymers Nanocomposites & Modelling

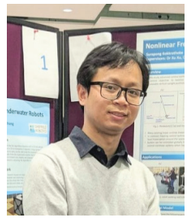
Can pre-course anxiety & attitudes predict grade?

Students often have preconceived ideas and anxiety about courses which may impact on learning behaviour and even performance. This paper uses survey data from Maths and Psychology undergraduate students to better understand how academic constructs such as self-concept, anxiety, task value and performance relate to each other in the context of learning statistics.

Although prior literature suggests that anxiety impacts negatively on performance this paper shows that relationships between motivational beliefs and performance are moderated by statistics anxiety and that addressing task value and self-concept may be beneficial in reducing anxiety for different groups of students.

Mini Profile

Senior lecturer (BSc Mathematics), statistics support coordinator and mother of two! Passionate about making learning statistics as pain free as possible!



Surapong Kokkrathoke

Supervisor: Dr Xu Xu
Centre for Automation & Robotics

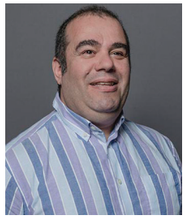
Tracking and Balancing Control of the LEGO Two-Wheel Robot with Extended Kalman Filter

This paper introduces a nonlinear freezing optimal control (NFOC) technique combined with an extended Kalman filter (EKF) for balancing a two-wheel robot (LEGO EV3 Robot). Most traditional controllers are based on linear methods, which need to linearise the system around an operating point. Therefore, they can only operate in restricted ranges. In this research, the simulation results show advantages of the nonlinear controllers over the linear quadratic regulator (LQR) as they demonstrate wider operation ranges when starting from various ranges of initial pitch angles.

Moreover, the addition of EKF in implementation removes the signal drift problem in the gyro sensor. Furthermore, the tracking system design presents satisfactory results as the robot moves to the reference position while balancing itself.

Mini Profile

I am an engineer at the Synchrotron Light Research Institute, Thailand. I have a scholarship from the Royal Thai Government. I graduated in my Master's degree from Sheffield Hallam University in 2018. Now, I am a third year PhD student. I am currently doing research on nonlinear control techniques for self-balancing robot.



Professor Antonio Feteira

Inaugural Professorial Lecture – Antonio Feteira – by invitation only
Advanced Functional Materials

What have ceramics ever done for us?

Historically, the first tools were made from stones. Those stones meet our current definition of ceramics, which is the art and the science of making and using solid objects, composed essentially of inorganic non-metallic materials. This lecture will provide a "biased" view of the importance of ceramics in the modern world, particularly in the field of electronic ceramics. Indeed, ceramics are not only the oldest materials but are also among the most sophisticated ones.

Mini Profile

Antonio is a Professor of Advanced Functional Materials at Sheffield Hallam University. He received his PhD degree in Materials Science and Engineering from The University of Sheffield, where he holds a visiting position. In the past, he was a Senior Research Fellow at the University of Birmingham, having previously worked in the R&D department of TDK EPC, Austria. He held visiting research positions at Penn State University, Warwick University, Max Planck Institute and Complutense University of Madrid, UFPeL. Antonio's research focuses on advanced ceramics for electronics, including actuators, energy storage devices, temperature sensors and wireless communication resonators. He is an associate editor for the Journal of the American Ceramic Society and the Journal of Electronic Materials and editor for the International Journal of Applied Ceramic Technology.

Dr Mukesh Goel (Staff talk)

Senior Lecturer in Chemical Engineering
Department of Engineering & Mathematics

Exploring Bioleaching for the Sustainable E-waste Disposal

The environmental and economic consequences of electronic waste (e-waste) is becoming more and more evident. The use of electronic devices and equipment has surged in recent years due to technological advancement, especially in materials and software. There are now more devices connected to the internet than there are humans on the planet. It is expected to persist, driven by soaring consumer need and diminishing costs. E-wastes, however, are great potential for recovering prized metals such as gold, silver and copper, and even rare earth metals such as indium. They are rich in resources, possessing much higher metallic content than natural ores and recovering these metals is much more economical compared to industrial mining. They also contain many hazardous metals such as lead, mercury, etc. Thus, an environmentally benign process for recovering these metals must be explored. Bioleaching using microbes and fungi bids a more sustainable approach to metal recovery. It has low energy consumption and leaves a not so significant environmental footprint. Innovative bioleaching using novel biological and engineering methods promises to be a more attractive option for the sustainable e-waste disposal resulting in metal recovery. This paper reviews various research contributions in the innovative bioleaching of the e-waste.

Mini Profile

Dr Mukesh Goel completed his M.Eng in Chemical Engineering from NUS Singapore, and PhD from IIT Delhi (in collaboration with University Lyon1 and INSA Lyon, France). He has been working as a Senior Lecturer in the Department of Engineering and Mathematics, Sheffield Hallam University since September 2019. His research areas include the treatment of wastewaters and generating bioenergy. His experience includes eleven years of teaching & research experience and two years of industrial experience. On the publication side, he has 37 international journal papers, 26 conference papers, and four book chapters. Besides, he has written nine technical reports for industries and has worked in three funded projects. He has guided 14 PG students, two PhD students, and UG students.

Hassan Majiya
Supervisor: Dr F. Clegg
Polymers, Nanocomposites and Modelling Research Centre

Bentonite-Chitosan composites or beads for heavy metal adsorption: design, preparation, and characterisation

Water contamination with pollutants such as heavy metals is of significant concern because the toxicity exhibited by these metals can pose a severe threat to human health and the environment. Adsorption with the use of geological materials (such as clays) and biodegradable polymers seems to be a promising technique for purification of water contaminated with toxic metals. These materials not only provide a cost-benefit, but are also interesting materials derived from sustainable sources and are thus environmentally friendly.

The current research project focuses on the preparation of functional composites or beads from bentonite clay and chitosan biopolymer.

Mini Profile

I am from Nigeria; I obtained my BSc. (Hons) Chemistry and MSc. Analytical Chemistry from Ahmadu Bello University, Zaria. My PhD research project focuses on the preparation of functional composites from bentonite clay and chitosan biopolymers as a cost-effective removal of toxic metals from water. Outside academic, I love watching soccer.

Katrina Love, BEng(Hons) EngTech TIMMM AFHEA
Supervisor: Prof. Paul Bingham
Polymers Nanocomposites & Modelling

Phase separation in sodium borosilicate glasses doped with phosphorus pentoxide

The aim of this work is to establish the on-set of phase separation in a sodium borosilicate glass system doped with phosphorus pentoxide ($Na_2O - B_2O_3 - SiO_2 - xP_2O_5$) and understand the mechanism by which it has occurred. It is also to understand the effects increasing P_2O_5 has on the properties of the glass. Some of the techniques used to characterise the samples were XRD, FEG-SEM, DTA, dilatometry and Raman spectroscopy.

Mini Profile

I am from Sheffield, born and raised, and did my undergraduate degree in Materials Engineering at Hallam.

James Eales
Supervisor: Prof. Paul Bingham
Polymers Nanocomposites & Modelling

Structural changes in borosilicate glasses with varying Fe_2O_3 contents – a multi-spectroscopic approach

Two series of borosilicate glasses relevant to US radioactive waste vitrification were incrementally doped on a pro-rata basis with iron (III) oxide. Raman, Mössbauer, and X-ray absorption spectroscopies were carried out to investigate the changes in the glass structure as a function of nominal iron oxide concentration. Mössbauer spectroscopy showed that the iron exists as Fe^{3+} tetrahedral units, while Raman Difference Spectra (RDS) showed significant changes to both the borate and borosilicate ring structures.

These changes were further investigated using boron K-edge X-ray Absorption - Near Edge Structure (XANES) which showed a gradual change to the [3]B/[4]B ratio as iron oxide concentrations increased.

Mini Profile

I am a third year PhD student working on a project that contributes towards a major environmental clean-up of radioactive waste in the US. I attained an integrated master's degree in physics at Nottingham Trent University prior to coming to Sheffield. Outside of university, I am an avid fan of ice hockey and rugby union.

Stephen Agha (Staff talk)
Lecturer, Solid Mechanics and Dynamics Group
Centre for Automation and Robotics Research

Flying by the Sun: Development and future outlook of Solar-Powered Multi-rotor UAVs

The range of applications for unmanned aerial vehicles (UAVs) has grown rapidly in the last decade. However, the relatively short flight endurance of rotary-wing UAV remains a limiting factor for certain applications. The use of solar energy presents a paradigm shift from having all the required energy on-board at take-off to; generating energy in-flight. By decoupling the UAV from a charging station, this holds the potential to impart energy autonomy as well as extend the flight duration of aerial vehicles.

While solar-powered flight has been demonstrated for fixed-wing aircraft as early as 1974 with the Sunrise 1, the first solar-powered rotary-wing vehicle reported in the literature first flew in 2014. Implementing solar-panels on rotary-wing UAVs presents a different set of challenges than for fixed-wing systems. The main considerations include; providing sufficient unshaded surface area for placing the panels; effectively handling the weight and aerodynamics drag of the solar panel.

This talk will describe the challenges inherent in developing a solar-powered multi-rotor drone and present a systematic approach to adequately consider subsystem dependencies at the design stage. The stability and control of this system will explored alongside the main fabrication stages. This presentation will be briefly outline potential use cases and future directions of this research.

Mini Profile

Dr Stephen is a Lecturer in the Solid Mechanics & Dynamics subject group at Sheffield Hallam University (SHU). Prior to coming to SHU, Stephen carried out research in the fields of aerial robotics and surgical robotics. These include the design, modelling and control of a Solar-powered drone, design and development of a variable stiffness robotic retractor for application in keyhole surgery, and locomotion system of a capsule robot for use in colonoscopy. He received a BEng from the University of Port Harcourt in Nigeria, MSc from the University of Leeds and PhD from Queen Mary University of London all in Mechanical Engineering. Prior to embarking on research studies, his early career was in the service side of the oil and gas industry. His roles included Perforation and surface well testing at Xenergi oil field services and oil well cementing while at Halliburton Energy Services.

Jessica Rigby
Supervisor: Prof. Paul Bingham
Polymers Nanocomposites & Modelling

Foaming behaviour during vitrification of high-iron nuclear wastes: Alternative reductants

Foaming during vitrification of nuclear waste in a Joule-Heated Ceramic Melter is caused by trapping of batch gases, such as CO2 and O2, beneath a highly viscous reaction layer called the “cold cap”. Foaming restricts heat transfer during melting and can cause blockages of melter components. Sucrose is effective in reducing foam in wastes high in nitrates. However, for wastes high in multivalent species, such as iron, which produce O2 by high-temperature redox reactions, other carbon-based reductants are investigated.

Foaming behaviour and redox behaviour during melting is compared between a range of reductants, as well as the final glass quality.

Mini Profile

Originally from Liverpool, I moved to Sheffield to study a BSc in Theoretical Physics at the University of Sheffield and have remained here ever since, completing a MSc at Sheffield Hallam University and now studying a PhD at MERI. When not studying, I spend the weekends bartending and boxing, not usually at the same time.

James Derham
Supervisor: Dr Francis Clegg
Polymers Nanocomposites & Modelling

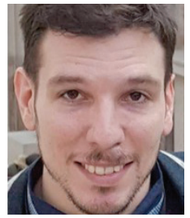
The characterisation, development, and optimisation of peracid-based disinfectant formulations for infection control

Utilising a high-level disinfectant in healthcare sectors is an essential asset for combating healthcare-associated infections. For a disinfectant to be deemed ‘high-level’ it must be effective at killing a wide range of pathogenic microbes. The most used peracid, peracetic acid (PAA), is a proven high-level biocide that is effective at killing endospore forming bacteria such as; *Clostridium difficile (C. diff)*.

After aqueous dissolution of a bleach activator and solid precursor of hydrogen peroxide (called a persalt), nucleophilic attack by hydrogen peroxide on the bleach activator takes place resulting in the *in-situ* generation of PAA.

Mini Profile

Professor Christine Le Maitre is Professor in Cell Biology and Tissue Regneration and leads the Tissue Engineering and Biomechanics research group in the Biomolecular Sciences Research Centre in the Department of Biosciences and Chemistry which is an interdisciplinary research group with strong ties to MERI. Christine’s research spans what goes wrong at a cellular level during degenerative diseases and cancer, to developing 3D culture models to study disease processes and the use of biomaterials and stem cells for regenerative medicine approaches to a range of diseases. Her research has led to ~70 peer reviewed publications with a current H index of 31 and an i10 index of 46. She has successfully secured ~£17 million in research funding, including funding from H2020, MRC, EPSRC, Versus Arthritis and the Wellcome Trust.



Cyril Maucourant
Supervisor: Prof. Fin O’Flaherty
Structural Materials & Integrity

Influence of Pre-Wetting on the Nanolime performance for the Consolidation of Limestone Museum Objects

Nowadays, the majority of stone conservation treatments carried out in museums use incompatible products to consolidate limestone artefacts. Through this talk, the focus will be made on the benefits that nanolime could bring as an innovative consolidation treatment in a museum context. The main steps of the PhD research methodology will be presented, the aim of which was to design a nanolime-based consolidation treatment with improved performance.

Mini Profile

Born in France, I did a BA in History of Art and Archaeology (Université de Bordeaux III – France), a MA and MSc in Conservation for Archaeology and Museums (UCL - London). My field of expertise deals with Stone Conservation and Heritage Applied Sciences.

Amanda Allison
Supervisor: Stephen Magowan
Structural Materials & Integrity

Powder Bed Fusion process parameter selection for Ti-6Al-4V alloy

Mini Profile

Amanda is currently employed by TWI Ltd as a Senior Technical Project Leader in the Laser Additive Manufacturing section, predominately working on the Powder Bed Fusion technology. She has an academic background in materials engineering. Her personal interests include hiking and watching her beloved Sheffield United play at the lane.

Musa Abubakar Bilya
Supervisor: Prof. Dharme Dharmadasa
Thin Films Research Centre

Optimization of Electro-plated CdSe layers for Photovoltaic Device Application

Mini Profile

I am a Nigerian by birth. I am here in Sheffield for a PhD programme in Material Science and Engineering.
I have BSc Physics from Nigeria and MSc Physics from India.

Sajjad Haider Choudhry
Supervisor: Dr Walid Issa
Thin Films Research Centre

Developing of energy management system to manage the power flow between solar system and energy storage system in the electric vehicles and DC microgrid

Mini Profile

I work as a lecturer at Chesterfield College of Engineering department since 2015. I also passed my MPhil from Manchester University in nanotechnology. I love meeting and helping people to achieve their qualifications and dreams. The thrill of travel and diverse cultures has enabled me to study and work all over the world. The challenge posed by learning new languages has assisted me to be fluent in Tagalog, Urdu, Punjabi and English.

Matt Cook
Supervisor: Dr Oliver Lewis
Polymers Nanocomposites & Modelling

Delamination of organic coil coatings

Mini Profile

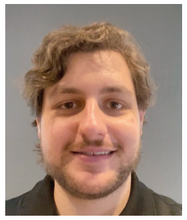
Matt Cook completed a Master's degree at the University of Manchester before starting to work at Beckers, the world's largest producer of coil coatings. He now works in the lab at Beckers, performing chemical analysis while studying part time for his PhD.

Joel Hirst
Supervisor: Dr Thomas Ostler
Polymers Nanocomposites & Modelling

Modelling Ultrafast Switching in Antiferromagnetic Materials

Mini Profile

My research interests focus on modelling magnetic materials, with particular emphasis on ultrafast THz-Induced dynamics. I finished my undergraduate studies at Sheffield Hallam last summer, where I gained a BSc in Physics. Outside of University I enjoy football, road cycling and esports.



Raphael Fortulan
Supervisor: Dr Sima Aminorroaya Yamini
Polymers Nanocomposites & Modelling

Developing high-performance thermoelectric materials for low to medium temperature range applications

Mini Profile

I'm originally from Brazil. I'm an Electrical Engineer with emphasis on Electronics and previously worked in Power Systems Modelling and Machine Learning Algorithms. Now, I'm doing my PhD in semiconductor-based thermoelectric devices.

Mohammed Lami
Supervisor: Dr Faris Al-Naemi
Centre for Automation & Robotics

Experimental study of thermal loss reduction in a double-glazed window for commercial buildings in cold environment

Mini Profile

Born in Basra, Iraq, I have a BSc and PG Diploma from Basra University, and a MSc from Sheffield Hallam University, UK. I am enthusiastic about farming, football and classic music.

Mary-Joan C. Oledibe
Supervisor: Dr Francis Clegg
Polymers Nanocomposites & Modelling

Remediation of Petroleum Polluted Water using Pulverised Polyethylene as Sorbent

Mini Profile

I am an Engineer with the Federal Ministry of Petroleum Resources, Abuja, Nigeria. I am a sponsored PhD student of PTDF (Petroleum Technological Dev. Fund), Nigeria. I have my first and second degrees in Chemical Engineering

Oluwaloba Oluwole-Ojo
Supervisor: Dr Hongwei Zhang
Food Engineering (NCEFE)

Modelling, Control and Analysis of Moderate Electric Field (MEF) in Food Processing

Mini Profile

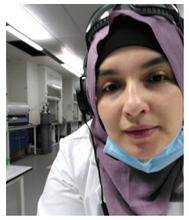
I am a first year PhD student, my current research is a fusion of control engineering, mathematical modelling, and industrial application of MEF in food processing. I love history documentaries, football, video games and everything tech.

Olamilekan Saheed Shobayo
Supervisor: Prof. Reza Saatchi
Centre for Automation & Robotics

Artificial Intelligence Technique Developments for Infra-Red Imaging Based Bone Fracture Screening

Mini Profile

I am doing a PhD in Robotics (intelligent machines). I finished my Masters in 2016 at Sheffield Hallam University and have lectured for over 4 years at Covenant University Ota, Nigeria. I am married with 2 kids. I have a few publications in Machine learning and Optical character Recognition.



Sarra A.Takita
Supervisor: Prof. Alexei Nabok
Thin Films Research Centre

Development of novel nano-biosensing technologies for detection of prostate cancer biomarker PCA3 using aptamers as specific bioreceptors

Mini Profile

An experienced pharmacist professional with success in clinical pharmacist roles in Tripoli Medical Centre, Endocrine Department in Libya. I obtained a MSc with distinction from SHU (BMRS) in Pharmacology and Biotechnology in 2017. I am well-organised, good in time management, enthusiastic in research and seeking academic carrier. My PhD is in materials (biosensor technology) and in collaboration with the Biomedical Research Centre.

Mariagrazia Tristano
Supervisor: Dr Basilio Lenzo
Centre for Automation & Robotics

Advanced vehicle dynamics models and state estimation to enhance vehicle passenger safety

Mini Profile

I am a first-year PhD student in Engineering. My work is mainly centred around vehicle dynamics and safety. I love listening to music and playing my ukulele, watching TV series and playing videogames.

Dasunika Ubeywarna
Supervisor: Prof Sameh Saad
Centre for Automation & Robotics

Dynamic Reconfiguration of Supply Chain Design for Risk management in the Digital Era

Mini Profile

I am an enthusiastic PhD student specialising in Supply Chain Design and Supply Chain Risk Management with an excellent academic background and industrial experience. I graduated with an honours degree in BSc in Business Management (Logistics Management), MSc in Logistics and Supply Chain Management and achieved the SAP University Alliances Award in 2019 at Sheffield Hallam University.

Parichat Yubonbanditkun
Supervisor: Dr Xu Xu
Centre for Automation & Robotics

Nonlinear Optimal Control of Yaw and Lateral Dynamics of Electric Vehicles.

Mini Profile

I am a first-year doctoral student in Robotics. I also have a master's degree in Robotics at Sheffield Hallam University. I am interested in robotics and vehicles. I am currently developing a nonlinear optimal controller for controlling the yaw and lateral dynamics of electric vehicles.

PRIZES

Prizes in the form of e vouchers will be awarded in the following categories:

The Professor Chris Breen Memorial Prize for best PhD student talk – Year 2 student
The Professor Chris Breen Memorial Prize for best PhD student talk – Year 3 student
Best PhD student poster

Prizes will be presented by Dr Emma Martin, Associate Dean Research and Innovation for the Faculty of Science, Technology and Arts.

Mini Profile

Dr Emma Martin is the Associate Dean for Research and Innovation for the College of Business, Technology and Engineering at Sheffield Hallam University. Emma joined the University in 2003 and has been Head of Department: Service Sector Management, as well as more recently Head of Department: Engineering and Maths. She has led across a broad range of provision working with professional bodies and international educational partners, securing international accreditations and global recognition. Emma's research background in Hospitality and Tourism has contributed to RAE and REF and she held the post of executive secretary for the discipline professional body for 4 years. She has won awards for Innovation in Teaching and Learning and her pedagogic work on employability has influenced course design, programme frameworks and university strategy.

Mini Profile

Professor Chris Breen's eminent research career spanned 42 years of which 26 years were spent as a dedicated and pivotal member of the Materials and Engineering Research Institute at Sheffield Hallam University. He was welcomed and often sought as an invited, keynote or plenary speaker at many national and international conferences. He had the ability to pitch his presentation at the right level ensuring it was accessible and relevant to the whole audience. With a smile and occasional, light-hearted touch (often comical) he intrigued and captivated his listeners. The naming of this 'best student oral presentation' prize in memory of Chris reflects the hard work and skill he shared whilst communicating scientific knowledge. It is indeed an honour for past and future student recipients to be associated and recognised with this prize for their high quality presentations.

Presentation Judges

Year 2 student talks:

Dr Francis Clegg
Dr Alex Shenfield
Dr Xu Xu

Year 3 student talks:

Prof Andy Alderson
Dr David Asquith
Dr Hywel Jones
Prof Christine Le Maitre

Poster Judges

Dr Sima Aminorroya Yamini
Prof Fin O'Flaherty
Prof Chris Sammon

Thanks to the members of the planning committee:

Prof Andy Alderson (Chair), Dr Sima Aminorroaya Yamini, Dr David Asquith, Dr Francis Clegg, Dr Xu Xu, Stephanie Portier, Clare Mills Roberts, Bryony Plumb, Jessica Rigby.

Flag Key

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Sheffield Hallam University | Materials and Engineering Research Institute

Sheffield Hallam University
Faculty of Science, Technology and Arts
Materials & Engineering Research Institute (MERI)
Howard Street
Sheffield S1 1WB UK

Tel: +44 (0)114 225 3500
Fax: +44 (0)114 225 3501
email: meri@shu.ac.uk

www.shu.ac.uk/meri