Sheffield Hallam University

Engineering

How to apply

Applicants should email their completed postgraduate application form to MERI-student@shu.ac.uk by 12 noon on Friday 29 January 2016.

Please indicate clearly in the body of your e-mail whether you would like to be considered for:

- Both scholarship schemes
- GTA scholarship only
- VC Scholarship only

Your application form should either a) indicate your preferred choice from the projects listed AND explain why you are interested in doing PhD research on this topic, how your skills and experience to date prepare you to embark on the project and discuss any challenges that you foresee in conducting the research or b) a research proposal for your own project idea. If you are interested in pursuing a project based on you own ideas, we recommend that you contact a relevant supervisor to discuss and develop your research proposal before submitting your application form.

Where English is not your first language, you must show evidence of English language ability to the following minimum level of proficiency: an overall IELTS score of 7.0 or above, with at least 6.5 in each component or an accepted equivalent. Please note that your test score must be current, i.e. within the last two years.

For full details on the eligibility criteria, see: www.shu.ac.uk/studentships/eligibility

Selection process

Interviews for MERI candidates will be held on Monday 29 February and Tuesday 1 March 2016

Shortlisted applicants will be required to give a 10 minute presentation (see below) followed by an interview. Interview panel members include the head of postgraduate research, a prospective director of studies and (for GTA applicants) a representative from the relevant teaching department. Where travel to Sheffield is not possible, interviews are conducted by Skype or conference call.

The presentation should outline your PhD research proposal or a research project you have already undertaken, as targeted to a non-expert audience, as we want to see how clearly you can articulate your ideas and key concepts. You may use PowerPoint if you wish or other visual aids as appropriate, but this isn't compulsory.

Research Areas

Ceramics and glass

Project 1: Enhancing the Toughness and Strength of Ceramic Matrix Composites for Amour Applications

Ceramic composites developed at the university are being manufactured at the spin-out company XeraCarb Ltd for use in highly demanding applications such as bullet proof armour. End users require further improvements in strength and toughness to enable lighter armour systems which are more tolerant to damage. This project will explore methods to achieve this by incorporating ceramic nano-fibre/whisker phases and/or novel forms of carbon (graphene /CNTs) in to the ceramic structure. The student will work with the university and XeraCarb to manufacture these novel materials and to test any improvements in the properties including strength, toughness and ballistic performance.

Project lead: H Jones

Project 2: Enhanced Ceramics Using Synthetic Biology

Synthetic Biology is a disruptive technology which can produce bio- inspired self assembling, nano-sized inorganic structures e.g. growing and locating nano-ceramic materials within a structure to produce optimum properties (e.g. nano-fibres/platelets or novel core-shell structures). Applications range from lighter bullet proof armour to more efficient solar cells. This is part of a larger project including Imperial College London and UK MOD. At Sheffield Hallam the work will concentrate on the nano-composite ceramic systems to which the methods developed at Imperial can be applied. The project will process and characterise the novel self-assembled nano-ceramic composites and measure some of their key properties.

Project lead: H Jones

Project 3: High Performance Electrical Steels for Reduced Electricity Use

The efficiency of electrical transformers has a large influence on the world's consumption of electricity. More efficient transformer steels with optimum Si content of 6.5% would be a game changing development. However, above 3.5% Si the steels become unworkable in conventional processes. Cogent are seeking out new technologies (e.g. nano or amorphous metals) that can increase the Si content while retaining the ability to mass produce and process the thin sheets needed. The student will review and select the most promising technologies and carry out synthesis, processing and testing work to identify a solution that meets Cognet's requirements.

Project lead: H Jones

Project 4: Enhancing the High Temperature Performance of Ceramic Matrix Composites

Ceramic composites developed at the university are being made at the spin-out company XeraCarb Ltd for use in highly demanding applications such as high temperature structural parts (>1400C). End users require further improvements in the temperature that these materials can operate at for applications such as hypersonic flight (>2000C). This project will explore methods to achieve this by modifying the composite to incorporate more refractory phases that enhance strength and resist high temperature effects (oxidation, thermal shock, melting). The student will work with the university and XeraCarb to manufacture these novel materials and measure improvements in the high temperature performance.

Project lead: H Jones

Project 5: Development of advanced composites for enhanced piezoelectric materials.

Piezoelectric ceramics are used in a variety of applications [Sterianou, J.Appi.Phys, 2009,106,084107]. Due to environmental concerns there is a need for development of lead-free materials [Feteira, J.Eur.Ceram.Soc., 2010, 30,1827] to replace commercially dominant Pb(Zr,Ti)O3. Unfortunately, ceramics are brittle and can develop fatal cracks under mechanical and electrical loads, resulting in component failure. Thus improving resistance to crack propagation is important for the enhancement of existing materials and the optimization of piezoelectric device performance. An approach to achieving this is incorporation of micro- or nano-reinforcement to produce novel ceramic matrix composites with enhanced mechanical properties [Kordatos, Appi.Comp.Mater, 2013, 20,961].

Project lead: I Sterianou

Project 6: Assessing the blast performance of ceramic/metallic/composite systems for vehicle armour

Blast protection is often achieved through the use of metallic materials (e.g. RHA Steel). However, metals which also have high level ballistic protection results in unacceptably heavy systems. Ceramics combined

with composites have a much lower weight and perform well against ballistic threats but do not perform as well in blast. The ideal systems may consist of a combination of ceramic+composite+metal. Optimisation of such combinations is difficult to achieve experimentally. This project will model the performance of combined materials using state-of-the-art code to find optimal solutions. The most promising combinations will be manufactured for testing in blast and ballistic environments.

Project lead: E Carter

Project 7: Performance Enhancement of Flow Control Technologies Through Application of High Strain High Temperature Piezoceramic Materials

Active flow control actuators typically incorporate a thin piezoceramic layer adhered to a metal substrate to drive a diaphragm at resonance or adapt the device morphology, producing useful fluidic outputs. The current technology is limited by yield stress and depolarisation temperature of the piezoceramic, which can fracture under high bending moments and become inactive at moderate temperatures. New generation piezoceramic materials report exceptionally high strains at reasonably high temperatures, ideal for improved performance of flow control actuators. The Studentship seeks to fabricate bespoke piezoceramic actuators, characterise their performance and investigate these materials for separation control and thrust vectoring applications.

Project lead: J Potts

Control Engineering

Project 1: Deep learning techniques in artificial intelligence for improved neural network based pattern recognition

For more than half a century computer scientists have attempted to create a computational model of intelligence capable of representing the world and making accurate predictions. However we are still a long way from this - especially in domains such as image interpretation which require both pattern recognition and processing of semantic concepts. Deep-learning architectures offer a way forward by more accurately mimicking the structure of the human brain - although it is only recently that advances in training algorithms have made such approaches feasible. This project aims to build upon the current state-of-the-art in deep-learning to develop improved real-world classifiers

Project lead: A Shenfield

Project 2: Combined small-scale solar heat, desalination and power generation plant feasibility study

Access to fresh water is a growing problem for humanity, driving famines, disease epidemics and mass migration. A low-cost self- contained plant could be developed to serve isolated communities. This project will combine solar heat with seawater desalination to create both micro-power and fresh water generation in a carbon neutral process. The work will involve modelling and quantification of heat flows, pressures and fluid flows required across the range of solar conditions, optimising the process and producing data across deployment scenarios. The project will compare energy and cost efficiency of the plant against current technologies and so prove the concept.

Project lead: J Stewart

Project 3: Real-time monitoring of vibrations in wind turbines

Demands on renewable energy resources such as, wind are on the rise. Wind energy is harvested using wind turbines (WT). The larger the size of a WT the higher is its efficiency; however, the WT becomes more vulnerable to mechanical vibrations amongst other technical problems. This research will focus on the development of a real-time WT condition monitoring system that measures any irregular vibrations and takes a corrective action so as to prevent a catastrophic incident or malfunction. The applications of the

project also include aerospace, automotive and any industry, which requires real-time condition monitoring specially for testing purposes.

Project lead: X Cui

Project 4: Shock wave - boundary layer interaction at transonic aerodynamic flows

Shock waves and boundary layer flows are fundamental phenomena in aerodynamics, and they become even more important at transonic flows when the Mach number is in a range of 0.8 to 1.2. Most of the modern commercial airplanes fly at this speed, even including the operation of the "feather" mechanism of the "SpaceShip Two" re- entry system. Theoretically, there have been enormous challenges to the modelling, computation and test for shock waves, boundary layer flows and their interactions. This project would expect the student to do some fundamental studies on the modelling and computation of the transonic flows using advanced approaches.

Project lead: X Cui

Project 5: Application of advanced control techniques for energy use optimisation

Stopping an industrial plant for off-line adjustments of the parameters results in loss of production and usually is undesirable. This makes on-line dynamic optimisation of the plant parameters during operation an important subject of research and development. On-line dynamic performance optimisation reduces the usage of resources and/or unwanted outputs of the plant as pollutants. The proposed research will address scientific and practical issues of the on-line model based dynamic performance optimisation of complex systems with particular focus on energy use optimisation. It will aimto further develop theoretical and experimental results to the level of possible commercial exploitation.

Project lead: T Breikin

Project 6: High Performance Turbo- Generator Design and Simulation for Hybrid Vehicles

The dependency of fossil fuels for vehicle propulsion, its effect on the environment and society has been criticized in recent years. A final year project had been carried out on feasibility study of using aturbo-generator in a domestic vehicle (2013 Clio Renault K9K 1.5 litre diesel engine). The preliminary analytical and numerical study is promising, which motivates this research project. The engine efficiency can be improved by extracting additional electrical power from the internal combustion engine. This theory can be applied for various scales of engines in other applications, such as large-scale diesel engines in marine power generation applications.

Project lead: Q Li

Project 7: Advanced Process Control for Effective Milk Processing

In the UK, over 6,800 million litres of milk are processed annually to produce butter, cheese, cream, milk powders and yoghurt, but variations in the total solids content represents a constant challenge for the manufacturers. Advanced Process Control (APC) techniques, such as Multivariate Statistical Process Control (MSPC) and Model Predictive Controller (MPC), have much to offer to improve milk product quality, producing benefits such as more consistent products, increased yields, reduced waste and energy costs. Working with Nestle and other industrial partners, this project will investigate empirical modelling, inferential estimation, on-line APC and effective optimisation of the milk processing system.

Project lead: H Zhang

Project 8: Use of Aircraft Under Wing Skin as Energy Storage Elements

There are numerous civilian applications where small UAV's would be ideally suited. Most identified commercial applications require that the power plant and the airframe to be completely integrated. A platform with extended loitering/range capability could be commercially exploited. An all-electric aircraft

places immense power requirement, conventionally provided by Lead or recently by Lithium Polymer batteries. The proposed project will attempt to create structural skin panels to store harvested energy which would be photovoltaic or recovered. The skin panels will be made in the form of ULTRA CAPACITORS, which could actively be configured to provide energy density or power density.

Project lead: R Ali

Project 9: Way Point Analysis (WPA) using GIS for Electric and Hybrid vehicles

This project will determine and model protocols for the optimisation of power resource management in electric and hybrid vehicles. Transport models can be improved by appropriate consideration and manipulation of external data such as weather, GIS, congestion, time of day, etc. Here we will explore possible improvements to vehicle efficiency via systems programmed to use such data to dynamically predict power usage. Specifically, the project will seek to implement these protocols on microcontroller systems and servers so as to achieve live analysis. Thereby, approaches will be developed to improve, for example, vehicle range for a given terrain or journey.

Project lead: G Sparey-Taylor

Project 10: Modelling and Advanced Process Control of Ohmic Heating Processes with Applications in the Food and Drinks Industry

Ohmic heating is an advanced thermal processing method using electrical currents, which are passed through food to rapidly heat it for cooking or sterilization. Its principal advantage is its ability to rapidly and uniformly heat liquid products containing large particulates. Challenges exist in achieving effective control for different stages of heating. Innovative ideas are required to understand how the controllers should be modified to cope with different products and heating geometries. Mathematical and Multi- Physics modelling, and advanced process control techniques will be developed and implemented for more effective control. This project involves collaborations with C-Tech Innovation and food manufacturers.

Project lead: H Zhang

Design and Engineering

Project 1: TASCP - Tensairity Advanced Structures for civil protection and emergency

TASCP project relates to the study of tensairity lightweight structures, to the calculation and design modes and the definition of appropriate related industrialization methodologies. Tensairity allows realizing high strength inflatable structures with ad hoc reinforcement by ropes and composites. This project focus on the realization of tensairity structures for temporary housing temporary and emergency bridges and other structures which can be necessary for increasing the efficiency of civil protection operations. In particular the analysis of time of deployment with respect to more traditional structures must be performed together with the analysis of transport costs and different methodologies of deployments.

Project lead: N Pickett

Project 2: Smart Machine Design through Using Active Bearings

In wide applications in engineering rotating parts are often utilized such as compressors, turbines and pumps. Therefore, there is great interest in actively monitoring the health of the structure and predict and implement damage detection strategy for efficient repairs or for increasing the life of the structure. Active Magnetic Bearings (AMBs) played central role on smart machine design technology, through controllability and diagnosis to extend life of rotating parts and render operation safe. The research will focus on active adaptive control of rotating shafts and rotors by using ABM's through the implementation of dynamic load control strategies to mitigate vibrations.

Project lead: S Dakka

Project 3: Advanced grippers and adaptive grasp for irregular and variable food products

Food items are variable, irregular and easily damaged causing barriers and difficulties when using robotics and automation for manipulation. These complexities result in a reduction of flexibility and increased wastage. The aim of this project is the development of a flexible hygienic gripper able to handle a range of different products with varying geometries without causing damage. The gripper will be used to develop adaptive grasping strategies for these products and as such the project is multidisciplinary involving elements of control, instrumentation, machine vision, robotics, dynamics, mechanical design and simulation.

Project lead: A Rawsthorne

Project 4: MIDEO - Modular Industrial Design Environmental Optimization

Industry is using Modular Design (MD) as the basis of industrial product development. Academic optimization is instead focused on Multidisciplinary Design Optimization (MDO) methods. This project aims to define a dynamic modelling and optimization framework that could be exploited at industrial level, which couples MD with optimization criteria defining a new design method that can be defined Modular Evolutional Design. It allows finalising the evolution of design on the basis of the evolution of industrial components to a well-defined set of objectives of any nature (i.e. environmental impact, energy efficiency, reduction of costs, increase of some performances, etc.).

Project lead: M Transcossi

Project 5: ZEBRA - Zero Energy Building Renewable energy Addicted

This proposal aims to explore new building and walls structures, which allow a thermal stabilization both in summer and winter conditions. A thermal shield by a fluid which has energy exchange with the soil can be realized reducing the heat exchange between the interior environment and the external one. This effect increases the energy efficiency of the building and the internal comfort in any climatic condition. This approach allows innovation in building manufacturing allowing reducing the costs of realization. It can also couple with new techniques for fixing tiles, ceramic, and windows inside an industrial process that reduces build times.

Project lead: M Transcossi

Project 6: MICJ - Modelling of Industrial Coanda Jet

ACHEON FP7 project has introduced a breakthrough green propulsion concept with vectoring capability by selective adhesion of a composite jet to two facing Coanda surfaces. It demonstrated the suitability of such a propulsion system for aeronautic propulsion (in the subsonic range) achieving TRL 2. It demonstrated effective thrust and vectoring capabilities and the capability of solving environmental problems such as reduction of take-off and landing spaces, increasing climbing angle. The exploitation of the same concept for different technological processes will be explored through this research – for multiple industrial sectors focusing on definition, simulation and preliminary modelling of different architectures.

Project lead: M Transcossi

Project 7: Advanced heat recovery concepts and prototype development for application in the food, chemical and processing industries.

Industrial heat recovery has great potential and the National Centre of Excellence for Food Engineering has two innov8 projects to overcome some factors inhibiting performance (eg. contamination with corrosive and adherent particles that cause traditional heat exchangers to become clogged or damaged). While these projects will maximise heat exchanger performance, it is proposed here that there is a need for a new generation of concepts which break-free of the limitations of heat exchanger plates (eg. macro-

particles mixed with the waste stream to absorb heat for subsequently separated and heat recovery) to be taken forwards for prototype development with industrial partners.

Project lead: P Weston

Electronic Materials, Photonics and Photovoltaics

Project 1: High performance low cost embedded electronic system for high resolution ultrasonic non-destructive evaluation

Ultrasonic waves are applicable to non-destructive evaluation (NDE) of internal structures of opaque objects and assessment of macroscopic properties of opaque liquids for quality and process control purposes. Well established to date ultrasonic NDE applications include, among others, ultrasonic defectoscopes, parking sensors, sonars and medical imaging devices. The embedded system will combine appropriate electronic components (integrated circuits and/or off the shelf modules), firmware and software developments with custom printed circuit board design and manufacture in order to achieve high resolution readings without the need for a host computer at low cost and small form factor. It will be verified experimentally.

Project lead: A Kalashnikov

Project 2: Development of organic- inorganic hybrid photovoltaic technologies for solar energy harvesting

Perovskite-solar-cells (PSCs) were claimed as one of the top ten science breakthroughs of 2013 owing to their rapidly improved efficiency from 3.8% in 2009 to over 20.1% in 2015. Their potential in fabrication using low-cost materials and roll-to-roll manufacturing processes has attracted tremendous attention all over the world. However, significant challenges are still faced by PSCs for commercialisation owing to poor stability and toxicity of lead. This project aims to address these problems via our very latest patent-pending technologies. Proven concept of these technologies offers us unique routes to remove toxic lead, to enhance stability, and to further improve efficiency.

Project lead: H Wang

Project 3: Optimisation of next- generation solar cells based on graded bandgap structures using electroplated semiconductors.

The SHU Solar Energy Group has established over 12 semiconductors using low-cost electroplating over two decades. The group has also designed a graded bandgap solar cell (the world s first reported instance), and experimentally tested its validity. The group is now developing these new devices with scalable electroplated materials based on CdS/CdTe. The latest devices showing 15.2% conversion efficiency place the SHU Solar Energy Group among the global top 10 research groups working on CdS/CdTe solar cells. This project requires a high-calibre graduate with a physics, materials or electronic engineering background to increase efficiency to the highest possible values.

Project lead: IM Dharmadasa

Project 4: Nonequilibrium Many Body Simulator for Intersubband Transport and Optics

Intersubband-based Quantum Cascade Lasers (QCLs) and Quantum Cascade Detectors (QCDs) are the most complex semiconductor devices ever made. Advanced devices in the THz range cannot be fully understood and simulated with predictive power without Nonequilibrium Quantum Statistical Mechanics methods. This project will combine the expertise of two leading scientists in the field at SHU to deliver the new State of the Art Non Equilibrium Green's Functions intersubband transport and optics simulator. This project connects a major fundamental mathematical physics effort to cooperations with all leading industrial and academic QCL and QCD developers worldwide through COST ACTION MP1204, led by SHU.

Project lead: M Pereira

Project 5: Development of low-cost organic solar cells with longer durability and improved PV performance

Organic solar cells mainly based on bulk heterojunctions of conjugated polymers and fullerenes with have demonstrated efficiencies reaching up to 7%, as revealed in our recent publication. This is projected to reach more than 10% making OSCs a viable low- cost technology. The long term stability and durability of such devices however remain major issues to be resolved. The proposed research programme will focus on investigating the use of different organic coatings with light absorbing properties that can provide broader light harvesting capability as well as providing protection to the actual cell against environmental parameters that may degrade the cell performance.

Project lead: A Hassan

Project 6: Investigation and development of novel low cost nanogenerator technology

Self-powering sources are at the forefront of research and development with the aim of improving performance for industrial as well as medical applications. Highly efficient and sustainable self- powering sources based on energy harvesting from the environment are currently investigated, specially, piezoelectric nanogenerators using semiconducting, materials. The aim of proposed programme is to investigate low-cost methodologies to produce device structures with high energy harvesting efficiency based on piezoelectric as well as pyroelectric effects. The work will focus on the investigation of devices comprising ZnO nanorods as well as other Pb-free ferroelectric nanofibres that are deposited onto flexible conducting substrates.

Project lead: A Hassan

Project 7: Smart Battery Management System

Batteries are pivotal components of many systems such as renewable energy systems, standby power supplies and hybrid electric vehicles. However, their cost is high and their lifespan is dependent on charging/discharging regimes. This research will develop a generic smart battery management system (BMS). A BMS monitors operational parameters, such as charging and discharging currents, internal impedance, ambient and internal temperatures and activates protection circuits and generate appropriate alarm signals The BMS will also perform load balancing and isolate any battery should its measured parameters become out of safe limits. This project aligns the UA Doctoral Training Alliance on Energy.

Project lead: N Anani

Project 8: Maximum Power Tracking for Renewable Energy Systems

Due to the continuously changing weather conditions, the output power, from a renewable energy source, such as a photovoltaic (PV) array, is also changing and so is the maximum power point where an array must be operated. The problem is compounded due to partial shading effects, such as those caused by buildings, clouds, etc., which result in multiple peak power points. The research will develop a novel algorithm and a microcontroller implementation that will identify and track the global maximum power point so as to ensure that a PV system is continuously operated at its maximum possible efficiency.

Project lead: F Al-Naemi

Project 9: Multivariate image analysis of biomedical samples

Applications of image analysis are diverse ranging from surveillance, astronomy, geosciences and agriculture to pharmaceutical and biomedical images. Continuous technological advances in spectral cameras and the ever increasing computational power of modern microprocessors make infrared hyperspectral imaging a viable tool to acquire spatially resolved chemical information from several sample components simultaneously. Alongside these advances, new image analysis strategies are developed

including the application of different multivariate data analysis techniques. This project involves performing state of the art vibrational imaging measurements and applying a range of multivariate statistical techniques to analyse images of tissue samples for medical applications.

Project lead: K Mader

Project 10: Design of a system for non- invasive diagnosis of paradoxical vocal cord dysfunction

Paradoxical vocal cord dysfunction (pVCD) presents with breathlessness due to airway narrowing and in severe cases results in emergency intubation. The gold standard means of diagnosing pVCD is by laryngoscopy, an invasive fibreoptic scope inserted via the nostril, to visualise the abnormal vocal cord motion typical of this condition. This procedure is difficult to tolerate and is limited to specialist centres. An effective non-invasive system is urgently needed. A system consisting of an array of microphones and associated advanced signal processing will be developed to record, analyse and wirelessly transmit the respiratory sounds characteristic of pVCD and diagnose the condition.

Project lead: J Holding

Project 11: Design of adaptive ambulance noise cancellation system to protect infants transported in cots

The design and development focus for this PhD are digital signal processing, electronics and embedded systems. It invents a system that will significantly reduce (by about 10 dB) acoustic noise (e.g. siren, external and vibration sounds) picked up by an unwell baby transported in a cot by an ambulance. The disturbance caused by the extraneous acoustic noises intensifies the stress to an already stressed baby causing significant health deterioration and can increase the likelihood of death. There is an urgent unmet need that could lead to commercialisable product. The work is in collaboration with STHs and will be clinically evaluated.

Project lead: J Holding

Project 12: Development of a Voice Output Communication Aid

This research involves human communication interface, electronics, embedded systems and digital signal processing. The project will research the state of the art in Augmentative communication (AAC) and develop an innovative communication aid to help people who have a severe speech impairment to enable them to communicate. The device will evaluate a number of possible innovative steps to improve the efficiency and effectiveness of communication, such as: the integration of contextual information, use of natural language generation and language modelling and banking. This novel work will be in collaboration with an internationally recognised communication aid service (Barnsley AT team).

Project lead: J Rowe

Project 13: Design of a Biofeedback System to Assists People with Balance Dysfunctions

The design and development areas for this PhD research are electronics, biomechanics, embedded systems and digital signal processing. It will invent a commercialisable device to support patients who have difficulties with maintaining balance. It will monitor their body movements and assists them to correct their balance thus reducing fall. The device will reduce injuries and provides confidence to peoples with balance dysfunctions to lead a normal life. It will combine inertia measurement technologies (accelerometer/ gyroscope) and biofeedback mechanisms in a novel way to deal with balance dysfunctions. There is collaboration with STHs and the device will be clinically evaluated.

Project lead: J Stewart

Project 14: Design of a Portable Noncontact Respiration Rate Monitor for Incubators

The design and development areas for this PhD research are electronics, embedded systems and digital signal processing. Its aim is to innovate a commercialisable respiration rate (RR) monitor that is incorporated into infants incubators to reduce mortality. RR is the average number of times air is inhaled and exhaled and is an essential indicator of health. As there is no commercial noncontact RR monitor available, it is commonly not measured. The study will build on our world leading expertise on developing noncontact respiration monitors. It will be in collaboration with STHs. Extensive feasibility studies have been already carried out.

Project lead: R Saatchi

Project 15: Developments in Thermal Imaging for Bacteria Detection in Healthcare

Thermal imaging is a safe, non-invasive technology that measures infrared emission. Vascular access devices (i.e. cannulas) are present in the 48 hours before the onset of infection in 64% of healthcare associated bloodstream infections [1], (which are initially detected by redness and swelling of the insertion site). This studentship will develop thermal imaging techniques as a non-invasive means of early detection of cannula associated infections. This will be achieved in collaboration with Sheffield Teaching Hospitals by carrying out longitudinal studies collecting thermal and conventional images of the site of cannulas and the determining the presence or absence of bacteria.

Project lead: R Saatchi

Project 16: Thermal imaging in the localisation of joint inflammation in children and young people with juvenile idiopathic arthritis

Juvenile idiopathic arthritis (JIA) can be a chronic debilitating disease in children and young people (CYP), involving destructive and progressive joint inflammation.The proposed study aims to establish the potential role of high- resolution thermal imaging in diagnosis of active joint inflammation in children and young people (CYP) with JIA. Thermal imaging will be compared with MRI, clinician assessment and blood inflammatory marker measurement. The work will involve developments to better represent and extract relevant information from dynamic thermal imaging and in collaboration with Sheffield Teaching Hospitals. The work will be a continuation of a successful NHS funded study.

Project lead: R Saatchi

Energy Management

Project 1: Green Data Centre in Optical Cloud Networks

The project aim is to develop novel holistic approaches for reducing data centre s energy consumption in optical cloud networks. Data centres consume up to 3% of all global electricity production while producing over 200 million metric tons of CO2. Approximately over 35% of the total cost of ownership (TCO) of data centres is used for energy consumption. Therefore, it is very important to minimize the energy usage by data centres. Optimization of various possible strategies such as utilisation of renewable energy resources, energy- efficient data centre and optical network architectures will be explored and further developed to reduce energy consumption.

Project lead: B Pranggono

Project 2: Techno-economic studies of Bio-Succinic acid production from renewable lignocellulosic biomass.

Succinic acid is a petroleum based platform chemical widely used in food, pharmaceutical and chemical industries with a global market size of 30,000-50,000 tonnes/year at £4,000-6,000/tonne. Due to the depletion of petroleum, focus has shifted to renewable biomass resources. There are a number of emerging technologies for production of bio-succinic acid. The project will investigate the technological strength and economic viability of the most promising

technology for short, medium and long term implementation. The project involves synthesis of process flow diagrams and full-scale process simulation using ASPEN process simulator, estimation of capital-operating costs, cost-escalation for pioneer plant, and techno-economic analysis.

Project lead: F Kabir

Engineering Education

Project 1: The contribution of multi- disciplinary problem-solving interventions to undergraduate employability skills development

Universities are increasingly keen to emphasise employability skills development. For example, Sheffield Hallam University is ambitious to deliver academically-challenging programmes with an emphasis on professional practice. Graduate professional qualifications including Chartered Engineer, Chartered Mathematician and Chartered Scientist highlight the importance of teamwork, communication and interpersonal skills, both with specialists and non-specialists. This project will explore the contribution of cross-disciplinary working to this agenda by developing learning and teaching interventions with multi-disciplinary groups of undergraduates. The research will focus on the processes by which undergraduate students acquire, apply and disseminate knowledge from different disciplines to solve complex problems.

Project lead: P Rowlett

Project 2: Smart Technology for Enhanced Learning

The proposal is to research what is good engineering workshop application development of theory into engineering practice and supporting learning resources. There is extensive literature on pedagogy of science laboratories, the definitive literature for engineering laboratories typically cites Dewey (1910), however there is a lack of engineering education research into the impact of workshops on learning. The engineering accreditation bodies, require engineering degrees to have a significant workshop-based learning. The project objectives are to evaluate current student workshop learning; research and develop best practice through artefacts and blended learning materials to enhance students learning of theory into workshop-based practice.

Project lead: A Nortcliffe

Food Engineering

Project 1: Utilising CFD modelling to improve combustion efficiency and performance in industrial bakery ovens

The National Centre of Excellence for Food Engineering has excellent links with the food and drink industry, including companies in the industrial bakery sector. Currently, there is a drive to reduce costs, energy and carbon emissions by improving oven and baking efficiencies. To do this a greater understanding of the combustion and internal fluid flow is required. CFD provides an increasingly valuable tool to provide fast and accurate results. This project aims to extensively model an existing oven before developing novel methods to improve performance.

Project lead: P Weston

Project 2: Fibre enrichment in food products

Fibres, both digestible and non-digestible dietary, have several health benefits. Non-digestible fibre comprises an essential element in the human diet to slow down the cholesterol absorption in small intestine. However, fibre enrichment has a diverse effect on food appearance, taste and texture. This research will explore entirely fibre encapsulation possibilities to minimize the diverse effect on food; such as fibre-encapsulated powder can be embedded into food matrix to enrich food functionality maintaining

same food quality. The study includes non-digestible fibre extraction from fruits or vegetable peels followed by a suitable encapsulation technique to maintain the standard of food perception.

Project lead: B Dubey

Project 3: Stabilization of foam and emulsion by naturally resourced fibre particle for excellent performance

The foam and emulsions are thermodynamically unstable and recently pursuing a challenge to stabilize the foam or emulsion during backing or spray-drying process. Research shows that the micro or nano-particle stabilized-emulsion (Pickering emulsion) or foam performs better in liquid state than small-molecular-surfactant or protein. However, the effect of the stabilized Pickering emulsion or foam performance and dynamics during backing or drying has not been intensively investigated. The present study will investigate the stability of naturally resourced surface-active particle stabilized emulsion or foam and will extend to heat treatments, and will also explore the performance in combination with proteins (e.g. beta- lactoglobulin).

Project lead: B Dubey

Functional Coatings

Project 1: Spray drying process development for multicomponent encapsulation in a single powdery system using double/multiple emulsion

Emulsions are widely used in many industries (e.g. food, cosmetic, pharmaceutical). Double/multiple emulsions offer an advantage over simple-emulsion, as they have the capacity to hold both polar and non-polar components in one, and can also be tailored concerning release properties by modification of interfacial-layers. Long-term stability of double/multiple emulsions is still a non-solved issue. Therefore, powder formation from emulsions would be a technological solution to overcome this problem. In the present study, a spray-drying process will be developed for multicomponent encapsulation in a single powdery-system using double/multiple emulsion, where controlled-release kinetics in a physiological environment would be key success criteria.

Project lead: B Dubey

Project 2: Process development for controlling undesired polymerization of Na-silicate during spray drying

Na-silicate is a bulk raw material of many industrial products for structuring the spray-dried products such as washing detergent. Na- silicate usually undergoes an undesired polymerization during spray- drying in presence of CO2, which eventually leads to an unwanted product quality such as lower solubility of detergent. Spray-drying process optimization and catalytic implantation can slowdown the CO2 absorption and reduce polymerization kinetics. In addition, structuring the spray-dried particle can minimize the chemisorption and diffusion of CO2 into the spray-droplet inner layer. The successful implementation of the research project will open an opportunity to lead industrial research collaboration for product development in future.

Project lead: B Dubey

Project 3: Functional Thin Films

Oxide based functional thin film materials are used in semiconductor manufacturing, solar-cells, display and glazing industry as semiconductors and insulators for microelectronic components, transparent conductors for displays and solar cells and corrosion barriers for architectural glass coatings. There is increasing demand on materials performance which can only be achieved by improving the microstructure and the production methods. The project will develop high performance functional materials by exploiting a new production technology called high power impulse magnetron sputtering (HIPIMS), using pioneering

equipment and methods to perform an in-depth study of HIPIMS-of-oxides plasmas and the microstructure and texture of the resulting films.

Project lead: A Ehiasarian

Infrastructure management

Project 1: Application of Graphene in Concrete for Enhanced Performance

Concrete is widely used for its excellent performance in compression, and ability to be cast into various shapes. However, it has poor tensile properties (causing crack formation) and is semi-permeable. Ingress of aggressive chemicals and gases is therefore possible, leading to corrosion of steel used for reinforcement. This project will investigate the influence of graphene in concrete to improve mechanical (compressive, flexural and tensile strengths), deformation (shrinkage, creep, elastic modulus) and durability (permeability, porosity) properties. The effect on conductive properties of concrete will be determined, and could lead to innovative applications such as stronger, EM-shielded and impenetrable structural concrete.

Project lead: F O'Flaherty

Materials and Fluid Flow Modelling

Project 1: Development and Verification of Computational Models for Automotive Refuelling

The emission regulation policies from California Air Resources Board and the European Union demand stringent emission control especially with regard to automotive refuelling. Tests that lead to determining emissions during refuelling are now-a-days becoming expensive. Therefore, it becomes imperative to develop a simulation methodology for automotive refuelling. The project involves developing a computationally intensive multi-phase model coupled with multi-physics interaction during a refuelling event. Thus, it is anticipated that the models developed would potentially replace the expensive and inaccurate refuelling tests. This project provides good scope for possible collaboration with automotive Industries for experiments and model verification.

Project lead: H Viswanathan

Project 2: Development of a novel Stirling engine concept for disaster relief applications

The Stirling engine has the potential to exceed the efficiency and reliability of conventional engines. As they can utilise any heat source (including renewables and waste heat recovery) their potential application areas are limitless. On the bicentenary of their invention, these engines remain underexploited due to unanswered challenges in scaling, controllability, heat flux and sealing. This project will address these issues through investigation and further development of SHU's novel engine design, using analytical modelling techniques combined with experimental studies. The outcome of this work will be a modular multi-fuel proof-of- concept machine for power generation in disaster relief and aid applications.

Project lead: J Stewart

Project 3: Biomedical Applications of Multi-component Lattice Boltzmann Simulations

This project targets atherosclerotic initiation and interaction of flow with the vascular endothelium. The student will develop numerical / analytical methodologies to support biomedical applications of multi-component LBE simulation in a primarily mathematical / computational project extending (i) physical content, (ii) computational efficiency, (iii) numerical stability and (iv) parameter spaces of current blood flow simulation with an explicitly resolved cellular component. This project has considerable gearing (e.g. extant Beowulf Cluster) and recently the field has generated a successful first grant (T J Spencer), a REF 2014 case study, and collaborative experimental links with Prof. P Evans of UoS Medical School.

Project lead: X Xu

Project 4: Robotic Applications of Artificial Swarm Intelligence

The study of artificial swarm intelligence originated from biological swarm systems in nature, such as ant and bee colonies, and bacterial growth. Complex global behaviours emerge from relatively simple local interactions amongst the agents and also with the environment. This inspired the design of self-organising multi-robot systems, which has wide-ranging applications, eg. in many fast search and rescue tasks in hazardous environments, and in locating and killing tumours. This project focusses on the theoretical /mathematical study and biomedical applications of swarm multi-robot systems using cellular automata and Graph theory. A potential PhD candidate should have excellent mathematical &programming background.

Project lead: X Xu

Project 5: Multiscale Fluid-structure modelling of endothelial response and atherosclerotic initiation

The arterial lumen is coated by a protective cellular mono-layer, the endothelium. Conformational endothelial responses to a range of stimuli, including shear from the blood flowing in the lumen, expose underlying smooth muscle to the ingress of arteriosclerotic initiators, like leukocytes. Quantitative understanding of this process clearly rests upon the solution of a complex flow problem in which continuum fluid (plasma), explicitly-modelled deformable convecting particulates (cells) and evolving boundary shape all interact. Only the numerical model we aim to construct can provide that data which is unavailable to traditional experimental methods, upon which clinical hypotheses may be founded.

Project lead: I Halliday

Project 6: Development of a quantitative measurement system (DIC/PIV) for high-deformation fluid structure interactions

The ability to measure both flow and deformation simultaneously enables characterisation of flow related deformations or Fluid Structure Interactions. Such measurements are challenging but of great value for example in aero-elasticity and biomechanics. This project will develop new experimental approaches to correlate deformation and flow field information, based on a unique combination of Digital Image Correlation (DIC) and Particle Image Velocimetry (PIV). In order to establish the technique we will concentrate on idealised experimental models representing a variety of technological systems. The results of these will be used to derive characteristics as well as validate numerical FSI models.

Project lead: A Young

Project 7: Multiscale modelling of dispersion flow using volume coupling of Lattice Boltzmann Method (LBM) and Finite Volume Method (FVM)

Conventional Computational Fluid Mechanics (CFD), using FVM is successfully applied to macroscale problems. However, for problems involving micro- and mesoscale effects there is a lack of resolution (closure problem). LBM can model the micro-/mesoscale, but the required computer resources for application to the entire domain of a complex problem is prohibitive. We propose to use a coupling of LBM and FVM to overcome these shortcomings by combining the strengths of both methods. The project will concentrate on dispersion flows with elastic particles as these make up an important class of complex fluids used in a variety of industries.

Project lead: T Schenkel

Project 8: Thermal imaging developments for bone fracture screening

In collaboration with a local hospital, we are developing a technique for screening for bone fracture, using the thermal imaging signature of the injury-induced remodelling of local vasculature and hemodynamics. The method will significantly reduce the number of x-ray exposures and the cost of assessing bone

injuries for fracture. In this project, we will develop a quantitative, compartmentalised ("lumped"), multi-scale model of an injured physiology (the wrist) which, crucially, contains thermal processes (e.g. convective heat transport and tissue-heating), vessel adjustment and biological control mechanisms inter alia. The model will be accessibly implemented, explain observations and develop appropriate diagnostic scenarios.

Project lead: I Halliday

Project 9: Modelling and Simulation of In Barrel Projectile Motion

We Have currently a 24 Month KTP with EPA manufacturing who produce high specification sniper rounds. The Current associate is looking at statistical modelling and in flight modelling with a view to predicting the accuracy, linked with mechanical, geometric and aerodynamic properties. It has become apparent, that the in Barrel motion is also significant and vastly affects the exit velocity and the barrel dynamics the exit angle. Both these parameters directly affect the accuracy. The research proposal will attempt to predict exit velocity based on charge grain size, charge weight, combustion pressure, and mechanical properties of the bullet and barrel.

Project lead: R Ali

Project 10: Simulation of Hierarchical Self-Assembly

Very few of nature s micro- and nano-structured objects (cells, fibres, DNA, .) grow in a single step. Instead, they develop through a series of processes in which the products of one stage become the building blocks of the next. Recently, novel experimental work on colloidal systems and computer simulations of particle-based models (at SHU and elsewhere) have made fascinating progress in relation to these systems, particularly in identifying such series and, so, learning how to influence their "end products". Here, working with International collaborators and industry, we will use simulations to learn how real objects come into being.

Project lead: D Cleaver

Metallurgy and Anti-Corrision Technologies

Project 1: Predicting the wear of artificial hip joints

Experimental assessment of the wear of artificial hip joints is both time-consuming and expensive, and could be avoided by development of a reliable predictive wear model. The interaction between mechanical abrasion and corrosion which contribute to wear is complex and not accurately modelled to date. This study aims to develop a wear model exploring the abrasion and corrosion mechanisms operative in hip joint conditions, and will include the following methodologies: (1) Micro-abrasion testing of various hip joint materials, such as Co-Cr, stainless steels, and UHMWPE, (2) FE Modelling, (3) craterisation of wear scars using SEM, AFM etc.

Project lead: B Jana

Project 2: Preventing failures of the spallation neutron source target material

In collaboration with the STFC Rutherford-Appleton-Laboratory (RAL)*, this project aims to improve life of the spallation target material, made of tantalum cladded tungsten core materials. The target material often undergoes failure due to unknown mechanisms, which may involve Ta-W interface failure and degradation of the target materials caused by the coolant. This project will explore the failure mechanisms through FE modelling, materials characterisation and laboratory erosion-corrosion testing. This project is vital to the STFC's ISIS facility benefiting more than 3000 national and international scientists. *Test specimens,testing facilitates and additional funding of £5000/year for 3 years will be provided by RAL.

Project lead: B Jana

Project 3: Diffraction studies of depth resolved near surface residual strain in surface engineered metallics

The near surface residual stress state present in engineered components is critical in determining the initiation and early stage propagation of fatigue cracks. Typically stresses are measured as a single assumed component, careful measurements of the strain evolution during processing can elicit locally resolved 3D maps which can far better inform predictive modelling. Synchrotron diffraction has been used extensively to make such measurements but it is necessary to translate that work into a laboratory environment to provide routinely available data. This project will link existing synchrotron data to lab scale measurements and propose new experiments to further develop the field.

Project lead: D Asquith

Project 4: Microstructural re- orientation and crack initiation during fatigue loading

Crack initiation during fatigue loading is a stochastic process and dictates the starting point of a Paris-Erdogan crack propagation. Evidence exists to suggest that the initiation is dependent on favourable microstructral alignment, this occurs through re- orientiations during applied loading. This program of research will investigate the cyclic load dependant re-orientation and aim to link it to crack initiation and fundamental dislocation mobility. The work will be largely experimental with some basic dislocation simulation to corroborate observations. Studies using surface engineered (shot- peened, burnished, laser peened) material enable a study of heavily pre-strained material making changes more distinct.

Project lead: D Asquith

Project 5: Corrosion and Corrosion Fatigue of Friction Stir Welded Aerospace Alloy Joints

Friction stir welding is a joining technique which has applications in the aerospace industry due to its recognized benefits over traditional methods such as riveting, adhesive bonding and fusion welding. However, the effects of in-service damage caused by environmental degradation, fatigue and the synergistic effect, corrosion fatigue are less well documented and this is a concern in terms of aircraft safety and serviceability. This project will use electrochemical techniques to investigate the corrosion resistance of friction stir welded aluminium and magnesium aerospace alloy joints and the performance of such joints when subjected to representative corrosion fatigue conditions.

Project lead: O Lewis

Metallurgy and Composites

Project 1: Non-destructive monitoring of mechanical behaviour of aerospace materials

Monitoring the structural integrity of aerospace materials/structures is of paramount importance. Prevention of catastrophic failure as well as safe and economical management of the structures can be achieved by early assessment of material's condition before the appearance of large-scale damage. Systematic non-destructive monitoring of the materials performance for signs of damage or degradation will enable the realization of proper repair actions extending the useful life-span of an aerospace component. Today both NASA and ESA are applying NDE methods to study the mechanical behaviour and detect defects in shuttle wings, rudders, tails and other aerospace components.

Project lead: E Kordatos

Modelling

Project 1: The Investigative Role of Forensic Software in Road Traffic Accident Analysis

Road traffic accidents resulting in fatalities and serious injuries are a global phenomenon. By increasing understanding of how collisions occur, the frequency and severity of these events can be reduced. Computer modelling software can be used to simulate actual RTA scenarios to establish accident

causation and guide future vehicle design, infrastructure and policy. A study is proposed to compare the different software applications available for automotive forensic purposes using a selection of incidents involving various vehicle types and collision scenarios from the UK public sector. A methodology framework will then be proposed as a system of forensic crash investigation.

Project lead: E Carter

Project 2: Classification of biomechanical characteristics associated with the development of elite Olympic weightlifters

The interdisciplinary collaboration on this project, with support from British Weight Lifting, provides a unique opportunity to develop mathematical models of weightlifting, in combination with experimental studies, for enhancing performance of elite weightlifters. Through use of force profiling, anthropometric measurements and 3D motion analysis, this project will (1) investigate key biomechanical predictors of performance in weightlifting, (2) develop a profiling tool for identification of elite weightlifters and (3) optimise training techniques for weightlifters based on physical characteristics. It is anticipated that results will be used to design individualised training programmes to prepare Olympic athletes, and to develop a consultancy tool.

Project lead: L Haynes

Project 3: Exhaust Emissions and Noise Reduction in Diesel Engines

Recent, negative press attention has revealed the use of defeat- devices in cheating automotive emissions tests, which highlights the continued need to reduce emissions from diesel engines. Ethical research approaches will focus on the combustion process itself. This project will investigate strategies to reduce emissions and noises from a 4 cylinder turbocharged Diesel Engine by changing the fuel properties and hence lower the peak heat release rate. The project will involve a modelling study to optimise fuel-air mixing processes, and an experimental study to investigate the resulting torque, noise, reduced fuel consumption and emissions in relation to engine load.

Project lead: S Dakka

Project 4: Optimising the friction stir welding of multi-layered dissimilar metals using modelling at experiment

Friction stir welding (FSW) is becoming an increasingly important joining technique and is particularly well suited to the joining of dissimilar metals (e.g. copper, brass, silver). At Sheffield Hallam University it has developed for the large-scale production of mixed metal laminate composites. Optimisation of the process for mixed metal laminates requires an improved understanding of the flow of heat and material in the FS process. Modelling of this process is an efficient way to achieve this understanding. This project will develop a mathematical model which will be validated through experimental work on mixed metal laminates.

Project lead: M Marchesoni

Project 5: Mathematical modelling of hairy black holes

Einstein-Yang-Mills theory is a fascinating branch of gravitational physics that has attracted much attention recently. Here, we consider gravity coupled to a gauge field with some Lie group isometry, referred to as 'hair'. Typical questions concern the existence, stability and properties of solutions to field equations which model so-called 'hairy' objects. Applications are not limited to astrophysics; due to the AdS/CFT correspondence, this fundamental research can be extended to model condensed matter physics phenomena, such as superfluids and superconductors. This project will use a variety of analytical and numerical techniques to investigate aspects of hairy black holes and other phenomena.

Project lead: E Baxter

Polymes and Nanocomposites

Project 1: Novel self-stratifying polymer nanocomposites that provide extended control over infected wounds

Whether an open wound arises on the battlefield, at a major disaster site or as a long-lasting bedsore/ulcer, at home or in hospital, it must be treated effectively to remove infection and allow the healing process to begin. In order to combat this expensive problem, we have invented a novel polymer composite material that provides sustained and controlled release of an antimicrobial agent. This project will further our understanding of how the material s structure influences the antimicrobial release mechanism in order to develop, optimise and commercialise the system. We will achieve this by utilising a suite of sophisticated instrumental techniques

Project lead: F Clegg

Robotics and Machine Vision

Project 1: Robot on a lead

Many residents in nursing homes suffer from cognitive impairments and may restlessly walk up and down. The PHD project concerns developing a robotic guide which accompanies the restless; draws their attention to points of interest and changes restless wandering into meaningful walking. The project uses an off-the-shelf mobile robot, able to navigate the known (indoor) environment autonomously. It can take on a guiding as well as a following role, while the resident is holding a lead. The emphasis of study is on the spatial behaviour of the robot and its effect on the person holding the lead.

Project lead: J Penders

Project 2: Service robots for safety critical inspection tasks

Robots are widely used in manipulative tasks due to their reliability, speed and accuracy. Consequently, researchers continue to investigate novel applications. This PhD Scholarship focuses on service robotics applied to safety critical inspection tasks in industries such as railways, nuclear, manufacturing or infrastructure. The candidate is expected to identify the main features, challenges, constraints related with this topic. They will develop and implement a specific optimal design procedure together with relevant models and simulations. He/she will then design and test a service robot. The proposed project will demonstrate the potential of using robots to reduce risk to the human workforce.

Project lead: G Carbone

Project 3: Advanced cost effective robots with learning capability for the food sector

The main barriers to adoption of robotics in the food manufacturing industry are mainly the cost and associated payback required by the sector (typically less than 2 years). This makes the justification of new equipment very challenging. This project will research low cost robotic devices which are hygienic and cleanable and which can be easily reconfigured for different products. Key to this is the ease of reprograming, set up and autonomous behaviour in reacting to new products. The primary research topics will include the fusion of vision based methods and embedding intelligence and learning capability to support the autonomous behaviour.

Project lead: M Howarth

Project 4: A portable computer vision system for biomechanical analysis in sport performance

The project aims to investigate, design and implement a complete (hardware and software) computer vision system with multiple portable cameras that can be used effectively in a sport coaching environment as a support tool for the study and biomechanical analysis of the athlete s performance. This system will be used in combination with a number of sensor-based (gyroscopes/accelerometers) wearable sport

gadgets currently available from the market to provide athletes and coaches with a comprehensive analytical tool for biomechanics performance analysis and improvement.

Project lead: F Caparrelli

Project 5: Distributed Image Processing and Vision for Mobile Robot Navigation and Mapping

The project focuses on developing methodologies and algorithms for efficient robot navigation and mapping by a cluster of small mobile robots with enhanced locomotion and sensing capabilities. These robots are equipped with a number of on-board mini-cameras and embedded sensors that are used for navigation in an unknown environment. The main research challenges are: to distribute the processing of a vast amount of input image data within a single robot amongst the available processors; to extract meaningful information for collective robot navigation and mapping; to efficiently share the navigation information amongst all robots for the pursuit of a collective task.

Project lead: F Caparrelli

Project 6: Gesture control of mobile robots using wearable embedded devices

The project has two main objectives. The first one is to describe the current state of the art in the area of Human-Computer Interaction (HCI) applied to Mobile Robotics. This review will focus on using gesture and, possibly, voice recognition for the control of mobile robots. An overview of currently available sensor devices (gyroscopes, accelerometers, compasses, etc.) and wearable embedded devices and their applications will be given. The second objective is to design a novel gesture-based robot controller making use of wearable embedded devices. These can be integrated in clothes or other wearable items such as glasses or wrist watches.

Project lead: F Caparrelli

Project 7: Machine olfaction (electronic noses) for mobile robot applications - detection and localization of contaminants in search & rescue applications

The use of mobile robots and drones in search and rescue applications is now commonplace and with increased processing power now available complex sensor fusion techniques have been successfully employed to detect, localize and map targets. The focus of the project will be the development of a custom built Electronic Nose (ENose) sensor array for application on small mobile robots platforms and drones in order to detect and localize chemical spillages and leaks. The developed sensor system will subsequently be deployed and tested on suitable robot platforms and research undertaken to establish and optimize chemical plume tracking and localization algorithms.

Project lead: A Holloway

Project 8: Learning robot grasping techniques for fruits and brassica

A shortage of skilled labour and poor working conditions is encouraging the use of robots in food processing. This project is concerned with the post-harvest stage of fruits and brassica, focussing on handling and quality control. The investigation will look at data fusion techniques using optical and depth information (RGB- D), to create invariant shape feature descriptors. These descriptors will be learned by an Artificial Neural Network (ANN) controller to identify and classify the targeted product. Having determined the optimal grasp area, the product will be handled by an auto- reconfigurable gripper based on novel pneumatic finger tips.

Project lead: M Howarth