

2006-2007 MSc Projects for Mechanical and Robotics

No.	Description	Supervisors
1	<i>A Conceptual Design of a Multi-Role Autonomous Underwater Vehicle</i> (MSc Mech)	S Sharma, W Hall, R Sutton
2	<i>Application of Soft Computing Techniques to an LQG and LQG/LTR Design</i> (MSc Mech or Robotics)	W Naeem, R Sutton, S Sharma
3	<i>The Design of Guidance Laws based on Biomimicry Methodologies</i> (MSc Mech or Robotics)	S Sharma, R Sutton
4	<i>Remote Control of a Camera System</i> (MSc Mech or Robotics)	W Naeem, R Sutton
5	<p><i>World Class Manufacturing in India</i></p> <p>To assess the implications of attempting to adopt World Class standards of manufacturing in India. The project would involve a considerable amount of research into the current state of Indian manufacturing performance and how this compares this with World Class standards. It would determine the potential benefits to the economy of achieving world class levels of productivity and quality and discuss the political, economic and social factors that might impact on its development.</p> <p>The student might like to choose one particular sector of Indian manufacturing.</p>	Mike Miles
6	<i>Hydrodynamics of a tidal turbine using CFD techniques</i>	Ming Dai
7	<p><i>Underwater Vehicle - System for stationary hovering.</i></p> <p>1. Introduction</p> <p>Many small underwater vehicles (UVs) are provided with small positive buoyancy and submerge either by being flown downwards using hydroplanes or by using a vertical thruster to drive them down while otherwise stationary. The advantage of these systems is that they provide a measure of fail safe operation in that if the propulsion / power system fails they should drift up to the surface. However neither system allows accurate hovering while stationary.</p> <p>Providing accurate hovering while stationary is tricky, only very small changes in weight will cause a change from positive to negative buoyancy (and vice versa) and the slow changes are difficult to detect and correct for without over correcting. In some circumstances it is advantageous to be able to hover accurately, eg for certain types of inspection.</p>	David J Grieve

	<p>2. The Project</p> <p>You will be given some key information about the UV, weight, dimensions, etc and will be required to produce a detail design of an accurate ballasting system which will allow the UV to hover. As part of this detail design you will have to obtain the appropriate characteristics of the components you are using in your design so that you can develop a simulation, using Matlab Simulink which will simulate the hovering performance of the UV and how it is influenced by perturbations.</p>	
8	<p><i>Interlaminar shear strength of odd- and even layered composites</i></p> <p>A typical 800 gsm plain woven glass fabric has a ply thickness around 0.6 mm, while the standard interlaminar (short beam) shear strength test uses a specimen of ~2 mm thickness and ~10 mm span.</p> <p>The project would make plates of 3-, 4-, 5- and 6-layers of this fabric, using resin infusion with "standard" conditions. The samples would then be subjected to ILSS testing at span-to-depth ratios of 4/1 and 5/1 for each average plate thickness, with sufficient specimens to do each plate at all spans i.e. at other span/depth ratios. The cutting pattern should be allow for at least three specimens of each span at each distance relative to the progress of the flow front,</p> <p>I expect that the odd number-of-layer samples would have higher failure stresses because the highest shear stress would be in the centre of a lamina while the even number-of-layer samples would fail in the central resin-rich region?</p> <p>The project would develop skills in composite manufacture, mechanical testing, failure analysis and (optical/electron) microscopy for the examination of failure surfaces.</p>	John Summerscales
9	<p><i>Welding of Thermoplastic Composite Tape.</i></p> <p>A UK industry consortium is developing novel machinery to produce ‘off-axis’ glass/polypropylene prepreg tape. At Plymouth, we have a test rig which will enable us to investigate alternative options for heating and consolidation, which will eventually be incorporated into a commercial machine. One student is required to adapt and run experiments to explore the relation between processing conditions and weld quality. A second student could concentrate on heat transfer analysis, using numerical modelling techniques such as FEA.</p>	Dr Stephen Grove
10	<p><i>Microscopy of Random Glass Preforms.</i></p> <p>Resin Transfer Moulding (RTM) is a commercial process for composites manufacture. Its success depends on understanding the permeability of the glass fibre reinforcement – i.e. the resistance to flow experienced by liquid resin as it is forced through the mould. A PhD student is currently investigating methods for characterisation and measurement of permeability without necessarily using catalysed liquid resins. A project student is required to assist with the microstructure examination of composite samples – this will involve</p>	Dr Stephen Grove

	specimen preparation and novel image analysis.	
11	<p><i>Numerical Modelling of Resin Flow.</i></p> <p>Research Fellow Dr Wayne Wang has recently joined ACMC. He is a specialist in applying numerical simulation techniques to flow problems, especially those relevant to the manufacture of composite components. An enthusiastic student is sought to work with Dr Wang in the adaptation of existing software and/or the development of new models to problems such as pipe flow, permeation of resin through fibres and moisture absorption in composites.</p>	Dr Stephen Grove
12	<p><i>Heated Tooling for Resin Film Infusion.</i></p> <p>Tooling for large aircraft components is too big to fit into conventional ovens. An alternative approach is to incorporate integral heating into the tooling. The project follows on from work at GKN Westland Aerospace, and will investigate optimum tooling design and temperature control strategies. There are possibilities for both experimental and/or modelling work.</p>	Dr Stephen Grove
13	<p><i>Air Extraction from Infusion and RTM Resins.</i></p> <p>Laminate quality is generally improved if resin is ‘degassed’ under vacuum before injection. Although the process is simple, there are several factors which are poorly understood. What are the optimum processing conditions (temperature, time, vacuum level)? How can air removal be speeded up? What other vapours may be lost during degassing, and how does this affect the quality of the composite?</p>	Dr Stephen Grove
14	<p><i>Cost Modelling for Composites Manufacture.</i></p> <p>A largely theoretical project, aimed at developing a spreadsheet model to compare the part costs of alternative manufacturing routes. Considerable independent research would be required, using contacts with industry to establish baseline costs and financing methods.</p>	Dr Stephen Grove
15	<p><i>Resin Absorption by Core Materials during Infusion.</i></p> <p>Core materials are widely used in infused laminates used for marine, wind turbine and other applications. Resin absorption into cores such as polymer foams and balsa can add significantly to the weight of the structure, but we know very little about how this phenomenon depends on processing conditions, resin properties, core microstructure, etc. A systematic experimental programme is required, possibly with some theoretical modelling.</p>	Dr Stephen Grove
16	<p><i>Flexural Behaviour of Complex Sandwich Structures.</i></p> <p>Existing design guidelines for sandwich beams and panels generally consider only structures with relatively thin skins. Many applications now have much thicker skins, often including novel materials (such as SoricTM to promote resin flow). This project would consider how the response of these structures can be described, considering test procedures and/or design charts. FEA may be appropriate for a student with an analytical inclination.</p>	Dr Stephen Grove