Mechatronics

The Mechatronics Research Group is a newly established group bringing together the expertise of its members from different research and consulting disciplines, such as automation and control, mechanical design, medical rehabilitation devices and robotics, motion control systems, real time soft and hardware as well as micro-systems. The group is particularly active in the medical and rehabilitation robotics, micro-systems and functional materials, and industrial solutions.

Medical and rehabilitation robotics

- Focus is on providing computer assistive solutions and improvements to surgical, assistive and rehabilitation challenges.

Microsystems and functional materials

- The focus is on deploying materials such as piezoceramic, ZnO and conducting polymers for novel applications such as Microelectromechanical Systems (MEMS), sensors, etc.

Industrial solutions

- Providing mechatronics solutions for national and international companies, for example, an "indoor location system" which tracks the position of a radio-frequency (RF) transmitter and is based on a novel, patent protected estimation technique known as Partial Pulse Positioning (P3).

Wind Engineering

Wind engineering has been a strong activity in the Department since the 1970's. While most of the research has been on the effects of buildings on the wind environment, the laboratory also measures surface pressures for cladding design, and overall loads for structural design and prediction of acceleration for assessing whether human comfort guidelines are satisfied. Much of the research work is carried out in the de Bray wind tunnel as well as the Twisted Flow Wind Tunnel.

Current research projects include:

- Prediction of the response of high-rise buildings
- Computational modelling for the assessment of pedestrian level
- Winds
- The aeroelastic behaviour of vertical axis wind turbines
- Drag reduction for buses and cars
- Dynamics of building internal pressure induced through
- Dominant openings
- Turbulence around bluff bodies
- The structure of turbulence in the atmospheric boundary layer
- Turbulence characteristics of tropical cyclone winds
- Wind loads on Tropical Housing

Manufacturing Systems

The Manufacturing Systems research group provides a focal point for both fundamental and application-oriented research relevant to the technological development in the manufacturing industry. The group's vision is to become the centre of excellence in New Zealand for carrying out internationally recognised research in manufacturing. The research emphasis of the group is on intelligent manufacturing systems, STEP-NC, technology management, strategic manufacturing innovation, new product development and the design of automation and information technology for manufacturing companies.

Examples of the research projects include:

- Technology management and innovation in SMEs
- Strategic business improvement in manufacturing organisations
- Engineering management
- High Technology Design for Engineering Product Innovation
- Robotics and automation
- Intelligent, interoperable and adaptive manufacturing systems
- STEP-compliant CNC (STEP-NC)
- CAD/CAPP/CAM
- Business process re-engineering
- Computer-integrated manufacturing

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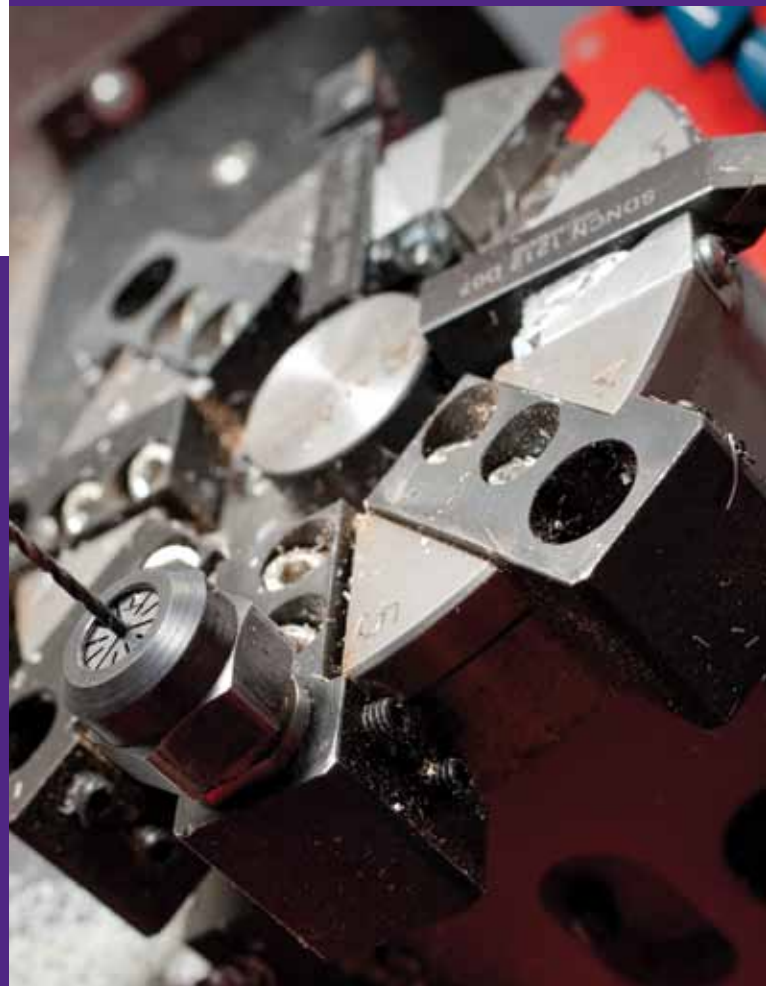
THE UNIVERSITY OF AUCKLAND
FACULTY OF ENGINEERING

Postgraduate Opportunities at the

Department of Mechanical Engineering



Postgraduate Study in Mechanical Engineering

The Department of Mechanical Engineering enjoys a long history of research excellence and top-quality postgraduate education. Currently, it offers Master of Engineering, Master of Engineering Studies, Master of Engineering Management and Doctoral postgraduate programmes. As a postgraduate student you will work with leading academics in the Department to solve real world problems at the cutting-edge of engineering advancement.

The research activities in the Department of Mechanical Engineering encompass a broad range of subjects, and are hosted by the following eight research entities:

- Centre for Advanced Composite Materials (CACM)
- Energy and Fuels Research Unit (EFRU)
- Yacht Research Unit (YRU)
- Computational Fluid Dynamics and Visualisation
- Dynamics and Control
- Manufacturing Systems
- Mechatronics
- Wind Engineering

Dynamics and Control

Research within the Dynamics and Control group encompasses a wide range of areas and varies from the cutting-edge, for instance artificial intelligence, to the applied, such as sound transmission through floors. Examples of these projects are support vector machines and neural networks, embedding structured human knowledge into control or decision making algorithms, stability control of mobile robots and active vibration control and applications of smart materials.

Other areas of recent research include:

- Structural acoustics
- Navigation and control of autonomous ground vehicles
- Multivariable control of wind turbines
- Non-Gaussian random vibration
- Shaker simulation of vehicle vibrations

Yacht Research Unit (YRU)

The YRU strives to provide world class sail testing facilities and endeavours to establish an environment where research related to yachts can flourish. Its Twisted Flow Wind Tunnel was extensively used by Team New Zealand in winning the America's Cup in 1995.

In recent years the YRU activities have been a mixture of theoretical and experimental research. In addition the wind tunnel facilities have gained a strong reputation and have been used by many high profile yacht design syndicates.

Its current research projects include:

- Modelling of deformable downwind sails
- Measurement of pressures on a sail
- Full scale measurements of wind velocity and turbulence measurements on a moving yacht
- Extensive CFD and model tests of a range of solid spinnaker models
- Digitisation of flying sail shapes
- Development of an aerodynamic model for a dynamic velocity prediction program
- Investigation of the aerodynamics of doublesurface sails

Computational Fluid Dynamics (CFD) and Visualisation

The CFD research group's particular fields of expertise are in three-dimensional flows, flows in enclosures having moving boundaries, and laminar and turbulent flows around airfoils. The development of appropriate and accurate algorithms to visualise the structures of three dimensional flows are an important thrust of the group's research.

Current research in this group encompasses the following fields:

- Patient specific models of arteries
- Design systems for sails and yacht rigging
- Computational methods for fluid - structure interaction
- Dual stream function based methods for flow visualisation
- Irreversible losses and entropy production
- Software frameworks for multi-physics simulations

Centre for Advanced Composite Yacht Research Unit (YRU) Materials (CACM)

The Centre for Advanced Composite Materials, conducts both fundamental and applied research, and provides prompt technology transfer in the composite materials area. The research team has established itself nationally and internationally through both in-house and collaborative research in the areas of design, manufacture, characterisation and modelling of composite materials for various applications.

Some of the current research activities include:

- Manufacturing of advanced composite products
- Characterisation of composite material behaviour
- Development of intellectual properties for commercialisation

- Numerical modelling of thermoplastic composite sheet deformation
- Manufacture and processing of wood and other natural fibre composites
- Biodegradable composites
- Numerical modelling of interfacial toughness
- Roll forming of thermoplastic sheets
- Manufacture of Bio-aids with thermoplastic composites
- Quality evaluation of carbon fibre weave through induced vibration
- Polymer-polymer composites
- Manufacture of hybrid nano-composites

Energy and Fuels Research Unit (EFRU)

Transport fuels and refrigeration are the major commercial research areas for the Unit. Fundamental research into the boiling and condensation heat transfer of natural refrigerants and application of the innovative refrigeration systems in the industry is the focus of the futuristic projects underway in the Laboratory.

The research is focused on developing novel energy efficient systems to improve the environment e.g. reducing fuel usage and emissions from internal combustion engines, energy efficient refrigerants/insulants in HVAC&R systems, and improving the rates of heat transfer.

Some recent projects include:

- Development of models to predict vehicle's emissions characteristics
- Heat transfer of natural refrigerants
- Cascade refrigeration systems
- Solar thermal systems
- Frost, its properties and its impact on heat exchanger design
- Waste heat recovery
- Energy efficiency in process industries