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<th>Staff member</th>
<th>Current number of PG students</th>
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<th>Research Topic areas</th>
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<td>Prof John Grundy</td>
<td>7 PhD, 1 ME (joint with John Hosking or co-sup)</td>
<td>2009: 1 PhD, 1-2 ME</td>
<td>Software tools, software processes, software architecture, model-driven development</td>
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<td><strong>Skills/background desired</strong></td>
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<td>John Grundy and John Hosking supervise projects in the broad area of &quot;software engineering&quot; but usually focus on projects with a software tools focus. Current research student projects with us include The Visual Wiki - a new way of visualising complex Wiki structures; Software performance engineering and model mapping; Design critics to improve software tool assistance to end users; Visual business process modelling and support tools; Natural language consistency management with software artefacts; Visual testing - both of visual languages and model-driven testing using domain-specific visual languages; Domain-specific languages for business report design and generation. We are interested in possible projects around further exploratory domain-specific visual language tool development e.g. using voice, gesture-based input, programming-by-example; new ways to support model-driven development e.g. of software architectures; and supporting better process/project management improvement e.g. via advanced visualisation in tools. These require good Java skills (or ability to pick up Java quickly from prior C#, C++ or whatever experience); usage of advanced software tools, ideally Eclipse IDE and Eclipse plug-in development; and ability to write up research results for international publication.</td>
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<td>John Morris</td>
<td>3 PhD</td>
<td>2009: 2 PhD</td>
<td>Accurate Rendering: The digital special effects found in modern movies require farms of hundreds of processors and still take months to complete a full movie. This project aims to move the critical computations to reconfigurable hardware and achieve speedups of 10 or more. Extensive feasibility studies and some preliminary work has been completed. However, a full system needs to be built and there is considerable opportunity for further optimizations of the rendering pipeline to speed up the rendering process and reduce power consumption. Generation of accurate 3D scene models in real time for object recognition and tracking: The computations needed for stereo matching prevent single state-of-the-art processors from being able to provide 'real-time' (25 frames per second or more) performance. By moving the stereo matching to attached reconfigurable hardware, however, we can obtain 3D 'movies' of a scene at 25 fps. This capability has many applications - ranging from collision avoidance in traffic through threat recognition to control of industrial processes.</td>
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**Other information**

- Detailed list of possible projects - [https://wiki.auckland.ac.nz/display/csidst](https://wiki.auckland.ac.nz/display/csidst)
- Possible+Student+Projects: Marama - [https://wiki.auckland.ac.nz/display/csidst](https://wiki.auckland.ac.nz/display/csidst)
- SPPI: [https://wiki.auckland.ac.nz/display/csisppi](https://wiki.auckland.ac.nz/display/csisppi)

Many individual projects can be tailored to your interests in this area!
Research Topic areas

Valeriy Vyatkin

Postgraduate Research Capability – Electrical and Computer Engineering Department

Research Topic areas

Industrial Visual Programming (Function Blocks), Formal verification of industrial programs by model-checking; Applications in energy distribution, baggage handling, flexible manufacturing

Skills/background desired

* FBench-tool for Visual Programming of Networking Embedded Controllers:
  - visual editors
  - distributed debugging and real-time monitoring of controller networks
  - refactoring of visual programs;

* Next generation of Industrial Embedded Controllers

* Intelligent Distributed Control of:
  - Flexible Manufacturing Systems using the available network of 50 microcontrollers implement new intelligent control algorithms;
  - Power Distribution Systems
  - Power-aware control of modular manufacturing system, powered with Inductive Power Transfer and batteries, plan the operation dynamically to save energy

* Modelling, simulation and formal verification of infoelectronic systems;

* Theory of Function Blocks;

Nirmal Nair

Research Topic areas

ELECTRICAL POWER SYSTEMS: DG/Renewable energy integration (Wind, Solar, Advanced Storage Batteries, SMART Distribution Grids, Micro-grid control); Demand Side Management (Substation Automation, Real-Time Pricing, Phase changing materials, Load modelling); Protective relaying (Wide Area Protection/control, IEC 61850, Voltage Stability, Fault Current limiters, Special Protection Schemes, Blackouts); Electricity Markets (AGC, FTR, Volatilities, Loop flow, Ancillary services, Impact of FACT devices)

Please meet to discuss specific details of the research topics & their requirements
Research Topic areas

WIRELESS COMMUNICATIONS: Project proposed by Tait Electronics – Radio location in PMR Systems:

Skills/background desired

PMR (Private Mobile Radio) channels are typically characterized by 12.5kHz channel spacing and are commonly limited to standard modulations and protocol structures. These systems are deployed across rural, urban and city centre locations each creating different channel distortion characteristics. The problem therefore is to identify the location of a caller ideally within 200m. Accuracies of 200m could be applied to public safety markets, but longer range estimates can be applied to fleet management companies such as couriers; taxis etc that merely need to know roughly where the assets are located. It is anticipated that three key techniques require investigation to solve the above problem (a) Improved synchronization techniques to accurately measure the relative time of arrival of the signals reaching sites. This includes the need to manage the effects of channel fading. (b) System design. i.e site locations to allow best possible triangulation. (c) Applying statistical techniques such as Kalman Filtering to improve the location estimate over a period of time and to allow all sources of data to be considered in the estimate. SKILLS REQUIRED: Understanding of wireless propagation, wireless systems, statistical techniques.

Research Topic areas

Energy-efficient embedded systems and low-power computer architecture including:
* Rapid energy estimation of multi-processor systems on chip (MPSoC) * Energy-aware processor communication for Multi-core embedded systems * Software optimisations for low-power embedded systems

Research Topic areas

I am working in a broad yet related areas of research: Speech Signal Processing to study the characteristics of speech signals; Speaker Recognition to identify and verify the identity of people from their voice; Speech Recognition to convert speech signals to commands that can control devices; Intelligent Environment to automate and intelligently control houses and buildings; Human Biometrics to identify and verify people from their physiological and behavioural attributes such as fingerprints, gaits, voice and many more; Speech Enhancement in Noise and Active Noise Control to reduce environmental noise in speech signals or cancel noise by producing anti-noise signal; EEG signal analysis and Brain-Machine Interfacing to analyze brain signals and pick some features that are affected by doing certain physical tasks; Audio Watermarking to hide information within audio/music signals for authenticity verification and copyrights protection of digital media.

Please contact me for more details about these topics.

Background in signal processing is essential in all of my research areas;

For more information please visit my webpage at http://www.ece.auckland.ac.nz/~wabd002 / and you welcome to email me at: w.abdulla@auckland.ac.nz
**Research Topic areas**

Healthbots project: 1 Masters in vital signs monitoring by a robot, 1 PhD in robot programming, 1 ME in wireless propagation for mobile robots (with Dr Michael Neve), 1 ME in robot speech production (Dr Catherine Watson), 1 PhD in speech recognition (Dr Waleed Abdulla), 1 Masters in Health Informatics (Prof Jim Warren in Computer Science/Medical and Health Sciences), 1 PhD in Clinical Practice Guidelines (Prof Jim Warren, Computer Science/Medical and Health Sciences), 1 PhD in Psychology (Dr Liz Broadbent, Dept of Psychological Medicine), 1 Masters in Healthcare (Assoc Prof Ngaire Kerse, General practice and primary healthcare)

Other potential projects include: helicopter robotics including navigation, robot programming tools, human-robot interaction (speech, vision, emotion recognition and generation)

**Skills/background desired**

Engineering postgrads need good programming skills and ideally skills in robotics and intelligent systems. Health informatics postgrads need programming, information systems and healthcare skills. Psychology and Healthcare postgrads need skills in those areas.

**Research Topic areas**

Healthbots Project -2 Masters , briefly mentioned by Bruce MacDonald?. In More detail Masters 1 Evaluating and modifying the ETRI robot software to generate english. The centre for Healthcare robotics has a series of robots made by the Korean Research group ETRI which currently speak Korean. The purpose of this project to create an English voice for these robots. The data to create various voices will be provided, but the speech synthesis system will need to be create. The aim of the project is to enable the ETRI robots to have large vocabulary, connect speech, recognisable to non-expert humans.

Masters 2 Empathetic Speech

This project involves working with synthetic speech for the robots from the centre of Healthcare robotics. It involves creating a platform which can produce synthetic speech of differing emotion, based on prosodic markup. The aim of the project is to generate speech that human users can recogniser as showing emotion. This is restricted to dialogs in healthcare such as “Your blood pressure is really too high”. With regards to PhDs I have a specific interest in a speech generation project around modelling aging in speech, this has applications for the Healthbot project, but it is a project in its own right. I am also interested in any projects around the area of speech generation, speech analysis, speech forensics (with Dr Bernard Guillemin) and music analysis/music recognition.

**Skills/background desired**

All students need good programming skills. For the two masters an interest in robotics, human computer interfaces is important, and for Master 2 an interest in speech generation is advisable. For the PhDs? good knowledge of signal processing and/or phonetics (for speech)/music theory (for music analysis) is important, and a willingness to learn about acoustic modelling.
### Patrick Aiguo Hu
- **4 PhD and 1 ME as main supervisor, another 4 PhD as co-supervisor**
- **2009: 2 PhD, only consider ME if it leads to PhD**

**Research Topic areas**
- Fully committed now but would like to consider 2 areas: 1) Wireless/Contactless power transfer for Biomedical and consumer electronics applications, 2) Application of power electronics in power systems.

**Skills/background desired**
- For the wireless/contactless power transfer project, strong power electronics background is essential, knowledge in biomedical sensors and actuators (eg heart pump) would be advantageous but not a must. For application of power electronics in power system project, fair understanding of power systems is important, good mathematical modeling and power electronics circuit development skills are required.

### Stevan Berber
- **5 PhD and 2 ME as main supervisor, another 1 PhD as co-supervisor**
- **2009: 1-2 PhD, 2 ME**

**Research Topic areas**
- Two areas: 1. Wireless Sensor Networks; Timing and positioning in WSN, 2. Multi-user systems; Physical layer design (Modulation and coding) and higher layers design

**Skills/background desired**
- In essence of a wireless sensor network operation is the knowledge of positions of its nodes. This research project aims to find methods and techniques that would be able to estimate positions of the network nodes with accuracy of one meter or less. It will include a detail analysis of the existing methods for positioning and the development of new ones suitable for sensor networks application. The methods need to be adopted for a low power consumption in the networks’ nodes. The second research area is in multi-user systems and networks: This is an extension of our research in CDMA systems and similar multiuser systems. The research will include an investigation of signal processing blocks for adaptive, reliable and secure communications. The research will also lead towards theoretical analysis and design of higher layer protocols in these systems and networks.