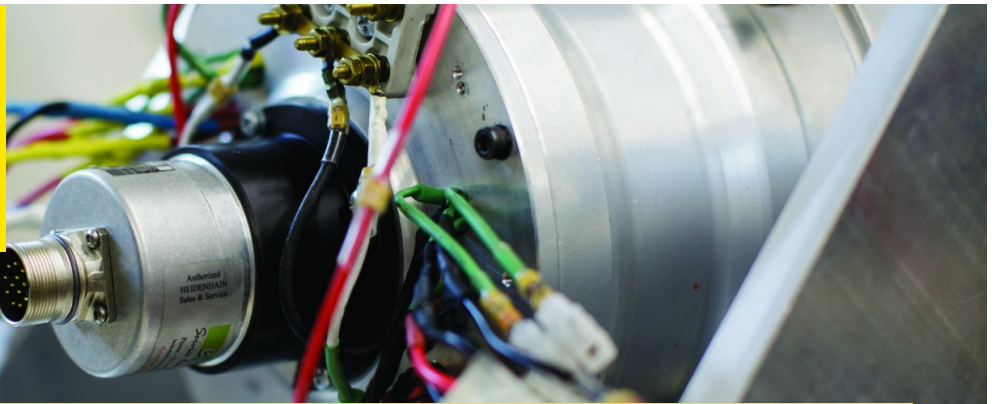




**UNSW**  
SYDNEY



## Design & Control of Permanent-Magnet Synchronous Machines

**Design, optimisation and control of various permanent magnet synchronous machine (PMSM) geometries, delivering improved torque and power density, reduced cogging torque, and extended constant power operating range.**

### Competitive advantage

- Expertise in highly efficient, low cogging torque, wide constant power speed range permanent magnet synchronous motors, generators and their advanced drive systems
- Development of the first sensorless control and fractional-slot concentrated wound IPM machines
- Expertise in enhanced control techniques, including direct torque and flux control, mechanical sensorless control and model predictive control
- Expertise in PMSMs for application in renewable energy systems
- Expertise in the design, optimization, manufacture and testing of IPM machines with V and other shaped magnets embedded in the rotor, as well as fractional-slot concentrate wound (tooth-coil) PM machines that demonstrate very high torque and power density and deep filed weakening range

### Impact

- More efficient motors and generators

### Successful applications

- Development of fractional-slot IPM machines
- PWM based sensorless control
- High-speed IPM machines

### Capabilities and facilities

- Finite-element packages such as Magsoft and Ansys, with optimisation tools that have been developed in-house
- Two and three-level inverters, several machine drive set-ups complete with shaft position sensors, torque sensors, highly dynamic loads
- Four-quadrant dynamometer, simulation platforms (Matlab-Simulink, PSIM), FPGA and DSP systems with high-performance signal acquisition, estimation and switch gate-drive interfaces

### Our partners

- Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC)
- CSIRO

### More Information

Dr Rukmi Dutta

School of Electrical Engineering and Telecommunications

T: +61 (0) 2 9385 7884

E: [rukmi.dutta@unsw.edu.au](mailto:rukmi.dutta@unsw.edu.au)

UNSW Knowledge Exchange

[knowledge.exchange@unsw.edu.au](mailto:knowledge.exchange@unsw.edu.au)

[www.capabilities.unsw.edu.au](http://www.capabilities.unsw.edu.au)

+61 (2) 9385 5008

