

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

# More Information

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#### **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