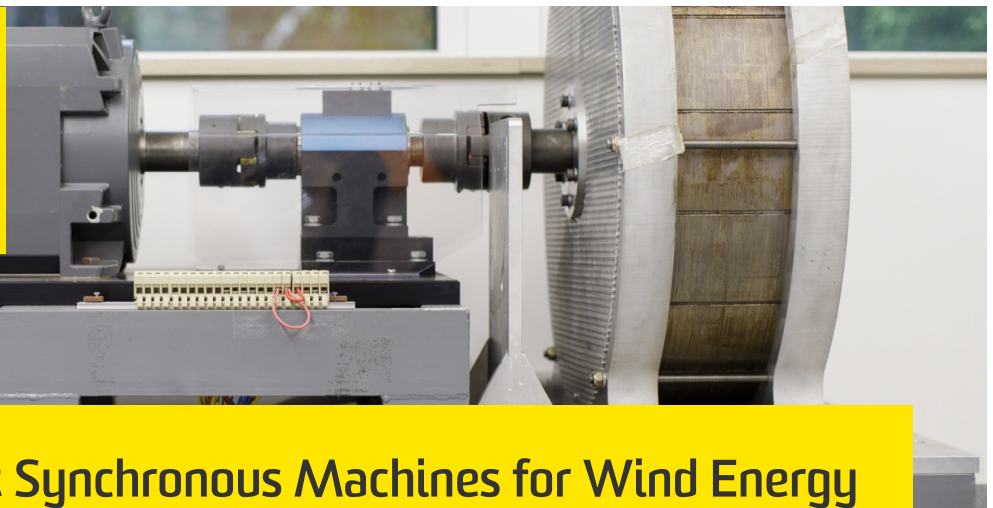# Permanent-Magnet Synchronous Machines for Wind Energy Conversion

Specialists in design and control of permanent magnet (PM) type electric machines. Strong capabilities in design optimisation and control of various PM machine geometries for low-speed, high torque applications such as direct-drive wind energy conversion.

Competitive advantage

- Expertise in designing direct-drive PM generators with compact size and negligible cogging torque.
- One of the world's first to develop fractional-slot concentrated wound interior PM machine for direct-drive wind energy conversion
- Advanced control techniques for the generator-side converters of Wind Energy Conversion
- Advanced techniques for on-line parameter identification with the possibility to use in remote condition monitoring of off-shore generators

Impact

- Direct-drive PM generators of compact size and with negligible cogging torque
- Cost-effective controller suitable for roof-top applications.

Successful applications

- Advanced control techniques for the direct-drive PM generators
- Patented Fractional-slot Concentrate Wound PM machine technology
- Pending patent application—design optimisation package for PM machine

Capabilities and facilities

- Finite-element packages, including Magsoft and ANSYS, with optimization tools developed in-house
- Simulation platforms (Matlab–Simulink, PSIM), FPGA and DSP systems with high-performance signal acquisition, estimation and switch gate-drive interfaces
- Two and three-level inverters
- Several machine drive set-ups complete with shaft position sensors, torque sensors and highly dynamic loads
- Four-quadrant dynamometer for testing direct-drive wind generators

Our partners

- CSIRO
- Wisconsin Electric Machines and Power Electronics
- Toshiba
- Regal Beloit

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