

Delft University of Technology is the oldest and largest university of technology of the Netherlands with 17,000 bachelor and master students and 4,700 employees. With its unique technological infrastructure, broad knowledge base, worldwide reputation and successful alumni, TU Delft makes a significant contribution to finding responsible solutions to urgent societal problems, at both national and international level.



Fault-tolerant, high power density integrated machine and drive for aerospace applications (75 kW, 4 kW/dm<sup>3</sup>)

### Research field and highlights

The research programme of the Electrical Power Processing (EPP) group addresses issues that drive the advancement of electrical power processors and at the same time brings into the picture broader systems design issues. Our research is driven by:

- New and improved materials and technologies;
  - Power density, force density, conversion efficiency and system integration.
- Power electronics and electromechanics are the central enabling technologies for advanced energy applications.

Power Electronics is a vital part of renewable energy conversion, mobility, transport and Smart Grids. The four main research themes in the group and some examples of projects in these areas are:



High power density (4kW/dm<sup>3</sup>) inverter for 2.2 kW drive (95% efficiency) – ECPE project

### Renewable Energy Conversion

- PV panel integrated dc/dc converters for distributed power tracking
- High power transformerless PV inverter
- Wave energy generators

### Transport and Mobility

- Converters and system integration for marine applications
- Fault-tolerant high-speed integrated machine and drive for aerospace applications
- Contactless energy transfer for charging of electric vehicles

### Smart Grids

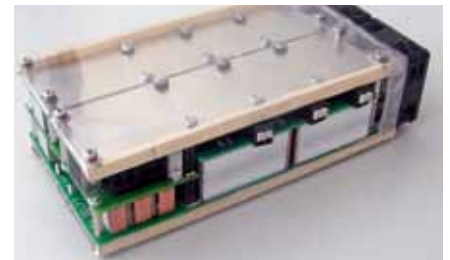
- Active power flow control
- Virtual synchronous generator
- Fault current limiter

### Technology Innovation

- Novel standardised passive components and technology for automated multi-layer SMT assembly of PCB power converters

- Packaging of wide band-gap (SiC, GaN) power converters
- High power dc/dc converters
- Systematic design approaches for EMI in drives

The EPP group carried out one of the ECPE flagship programmes “Industrial Drive – System Integration” focused on integration technologies and thermal management of inverters for low power industrial drives. The 2.2 kW project demonstrator had a power density of 4 kW/dm<sup>3</sup>, 4 times higher than state-of-the-art industry products at the time.



High power density (4kW/dm<sup>3</sup>), high efficiency (>99%) fully SiC, SMT compatible inverter for 2.2 kW drive (4.5 kW peak power) – ECPE project

### Facilities

The group has a well equipped laboratory with various machines sets and a distribution panel making it possible to interconnect machines and power electronic converters at different locations inside the laboratory. Ac and dc voltage levels up to 5 kV and power levels up to 50 kW is possible. Other equipment include EMI and thermal measurement equipment, pulsed power sources and energy storage devices.