POWER ELECTRONICSUK
Underpinning Research

Converters Theme

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EPSRC
Pioneering research and skills

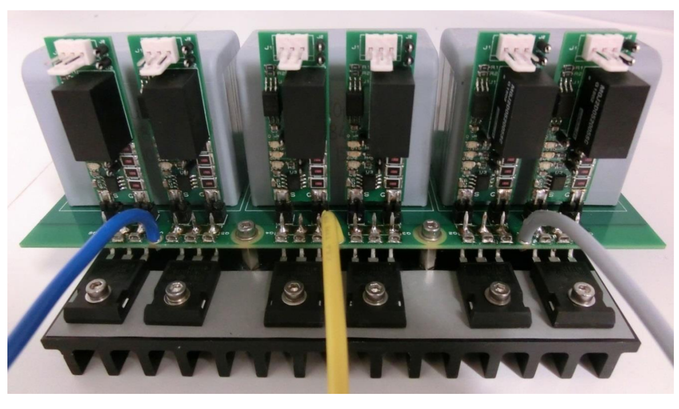
Underpinning Power Electronics: Converters Theme

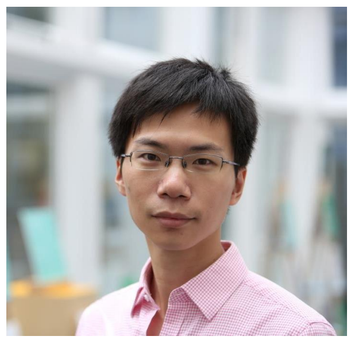
The converters theme explores two distinct areas of converter technology where the potential exists to make significant gains in performance; the first is in very large scale, high-voltage converters for future power generation and transmission systems, whilst the second is in ultra-compact converters, which are needed for a wide range of power conversion functions such as on-board vehicles, aircraft, and ships.

Achievements

Optimised high-density DC-AC converter

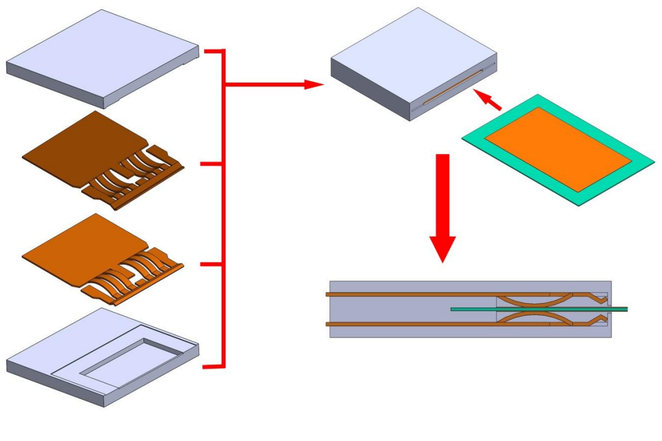
Dr Ian Laird has developed an automated design and optimisation tool at the University of Bristol for DC-AC converters including the line filter. Given a component database, the highest overall power density design is determined. A three-phase, 5kW silicon carbide converter prototype has been designed and constructed to validate the tool.

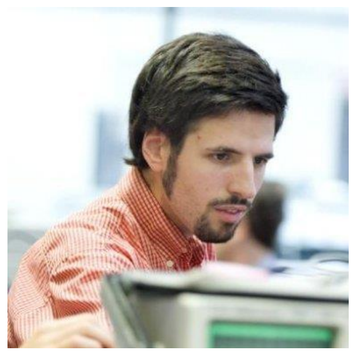




Building a new interconnect concept for low inductance switching

Dr Xi Lin is building a co-planar ‘blade-socket’ connection demonstrator at the University of Nottingham featuring a double sided ‘blade’ connector mated with a dual polarity ‘socket’ by spring contact. This concept eliminates the prevalent use of screw terminals in bus inter-connections, and will demonstrate the potential to reduce parasitic inductance and facilitate automated assembly in manufacturing.



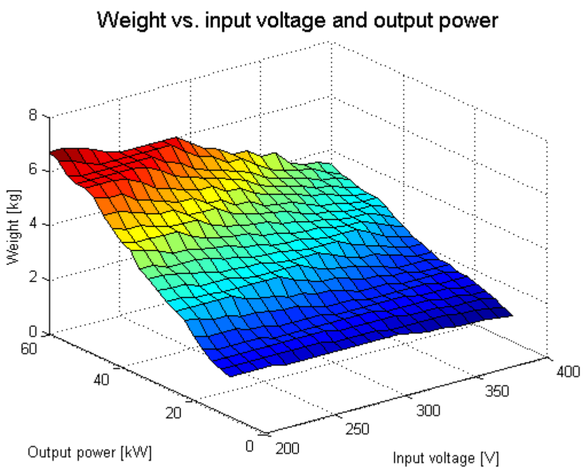


HVDC converter validation

Dr Michael Merlin is investigating the characteristics of the alternate arm converter (AAC). Hardware verification of the converter is being undertaken for the first time in scaled experimental tests at Imperial College London. The AAC is attractive since it can maintain current control through DC faults, unlike the more common modular multi-level converter (MMC). Also, during normal operation, the AAC has only a minimal efficiency penalty compared with the MMC.

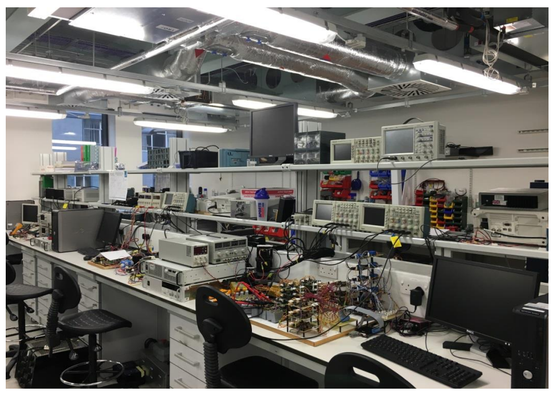
Integrated design tools for compact DC-DC converters

To enable rapid evaluation of alternative converter designs, including the magnetic component design, **Dr James Scoltock** at the University of Manchester has devised highly efficient algorithms which can reduce optimisation run times by up to 99%.The work is currently focussing on minimising the size of interleaved, multi-kW DC-DC converters using silicon carbide devices.



Thyristor based MMC using forced commutation techniques

Dr Peng Li at the University of Strathclyde will look at exploiting the low conduction loss and high current capacity thyristors with an auxiliary forced commutation arm in the modular multilevel converter. This is expected to extend power rating and improve semiconductor efficiency.



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