

Newsletter – Spring 2015

Funding Opportunities

This year the Centre will be funding projects in three streams, one for cross-theme topics, open to existing members, one for feasibility studies, open to non-members only, and a third open to early career researchers at any institution. Further details of the Centre and the calls can be found at www.powerelectronics.ac.uk. The deadline for applications is 3pm on 17th April 2015.

Annual Conference

We are pleased to announce that registration for our **2015 Annual Conference** is now open. The 2-day event will be held in Nottingham on the **29th and 30th June**, and will include updates from the research groups across our four themes and related EPSRC-funded Power Electronics research projects. To book your place, please go to: <http://www.powerelectronics.ac.uk/power-electronics/events/events.aspx>



Thermal Characterisation & Reliability Workshop

This event will be held at Nottingham University on 14th April 2015. Sponsored by Mentor Graphics, the workshop will cover the latest measurement system for fast, accurate, automated power cycling of power electronics components (MOSFETS, IGBTs, etc.) with integral thermal stack characterisation to track cause and effect for failure analysis.

ECPE Workshop: ECPE SiC & GaN User Forum

Being held at University of Warwick, 20th-21st April 2015. Last few places remaining. To find out more and to register please see the ECPE events webpages.

Congratulations

The University of Nottingham has been selected to coordinate the Power Electronics Spoke of the Advanced Propulsion Centre, bringing together academia and business to take ideas into production and boost the UK supply chain: <http://www.apcuk.co.uk/2015/03/uk-capability-in-automotive-power-electronics-and-battery-systems-boosted-by-creation-of-apc-spokes/>

The power electronics group, headed by Phil Mawby at Warwick University (Theme lead for Devices), won an award from the NMI for best UK University Research Group that demonstrates excellent liaison and partnership in electronics systems with industry. Well done to all of the team!

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Congratulations also to Prof Martin Kuball, a member of the Devices Theme, who is one of 19 recipients of this year's Royal Society Wolfson Merit Award: <https://royalsociety.org/news/2015/03/wolfson-research-merit-awards-march/>



Research Highlights

Components theme are investigating the use of low-CTE materials in PCB laminates to improve the reliability of our die-level planar interconnect technology. When sintered directly to the die surface the new laminates significantly reduce the interfacial thermo-mechanical stresses when compared to conventional FR4/polyimide systems. Compact inductors and high frequency transformers are under investigation for multi-kW DC-DC converter applications. The research includes the use of emerging core materials, new winding geometries and the embedding of thermal structures within the components to improve thermal management. Research into wound components subjected to ultra-fast switching transients is leading to models of the high frequency behaviour of wound devices. The work is being incorporated into a design tool for optimising wound filtering components suitable for wide bandgap devices.

Converters theme has devised a novel scheme for making low-inductance interconnections between power modules and other power electronic components such as dc-link capacitors. This disruptive technology avoids the use of screw terminals and preserves exceptionally low levels of inter-component inductance around the commutation path by employing a continuous co-planar interconnect. Circuit topologies and soft-switching techniques are under investigation to exploit most effectively the characteristics of emerging SiC power devices. The objective is to devise power conversion techniques that will enable a significant improvement in the power density of multi-kW DC-DC converters. A new four-level pi-type converter for low-voltage applications has been experimentally demonstrated to deliver very low output harmonic interference and low switching losses compared to the state of art. The approach has the benefit of a relatively simple converter structure and a simplified modulation and control method has been developed and demonstrated on low cost embedded control hardware. Within the cross-cutting topic of Design Tools & Modelling we are investigating development of software tools for design for reliability and robustness to include various failure modes and mechanisms in power electronics components. To predict robustness it is important to have fast thermal-mechanical fatigue damage calculations for interconnects. At present we have focused on solders, but the methodology being developed could be extended to other interconnect structures such as sintered silver. We are also investigating efficient electro-thermal models which can be used to provide inputs to the above models.

Devices theme First models for the physics of failure of GaN power devices have been built. These new models will advance the understanding of in-service reliability of the GaN power devices when operated under extreme conditions including at high temperatures."

We look forward to seeing at our conference in June, in the meantime, please see our webpages for details of other Power Electronics events.

Best wishes from the CPE team

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