Improving Efficiency of Magnetic Components in Switched-Mode Power Supplies

A novel mutual-inductance-based technique for measuring core losses in magnetic components of Switched-Mode Power Converters under DC bias, based on newly identified phenomena and enabling higher accuracy in component design, with increased converter efficiency.

The Challenge
Switched-Mode Power Supplies (SMPSs) are the prevalent means for power conversion in electronic equipment. Trends towards lower costs, smaller sizes, and demands for higher efficiency, mean the accurate measurement of the SMPS’ magnetic components performance under DC bias conditions is critical. These components exhibit losses as energy passing through the magnetic core is lost as heat or noise. Existing techniques (calorimetric, field-based and circuit-based) suffer from measurement errors that are difficult to minimise, so that accurate measurement of core losses is elusive.

The Solution
Researchers at The University of Auckland have discovered magneto-mechanical phenomena linked to the rate of core losses during the magnetic excitation cycle, and have developed a new technique to measure core losses in the magnetic components of SMPSs.

This technique is more accurate, simpler and less expensive than existing solutions. The method also includes an accurate prediction model for existing magnetic modelling software, aiding the design of new components.

Competitive Advantages
- Improved performances and reduced costs for magnetic components for SMPSs under DC bias conditions
- Proprietary: based on University of Auckland research into new magneto-mechanical phenomena
- Simple and inexpensive in comparison to existing measurement techniques
Power Electronics Research Group at The University of Auckland

Researchers in the Power Electronics Research Group within the Department of Electrical & Computer Engineering at The University of Auckland are involved in the development of inductive power transfer (IPT), motor control, electric vehicles, power electronics systems and magnetic modelling. Within the IPT space, the Power Electronics Group is arguably the recognised world leader in medium to high powered systems. Associate Professor Udaya Madawala and his team of researchers are working on commercially-focused development and research projects in relation to low cost electricity generation and management of sophisticated battery systems associated with IPT and other systems. Dr Madawala is a Senior Member of the IEEE and teaches both undergraduate and postgraduate courses in power electronics, electrical machines and heavy current electronics.

The University of Auckland

The University of Auckland is New Zealand’s leading university and is the only one ranked among the world’s top 200 universities by the Times Higher Education World Rankings of Universities. It is also the highest ranked New Zealand university in the QS World University Rankings and the Shanghai Jiao Tong Academic Ranking of World Universities. The University of Auckland is an international centre of learning and academic excellence. It is New Zealand’s pre-eminent research-led institution and has key linkages with many of the world’s top research intensive universities. Based in the heart of New Zealand’s largest and most diverse city, The University of Auckland has the most comprehensive range of courses in the country. The University’s mission is to be a research-led, international university, recognised for excellence in teaching, learning, research, creative work and administration. The University actively seeks to work with government, other universities, research organisations, businesses and commercial consultancies in research, development and education.