Final Report Summary
Study into a novel class of DC-DC converters for ultra-low-noise power supplies.

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Wound Magnetics Ltd specialise in the design, development and manufacture of wound components primarily for the Aerospace, Defence and Oil and Gas industries. In addition, the company carry out subassembly works for clients on both 'build to print' and 'in-house' designed systems.

Many of our clients design and use specialist power supplies and power supply systems. Noise within these systems is a major concern for a significant number of these clients. The project that the University of Strathclyde and Wound Magnetics have completed has demonstrated circuits to radically reduce the noise generated by SMPS's, for example, noise sensitive charge-coupled devices for sensor and imaging applications. The demonstrator circuit developed has potential applications not only within the high integrity markets that the company serve but the high volume technologies, for example, telecommunications and displays. The scope of the project will lead to an ability to effectively demonstrate the benefits of the innovation to potential users.

The University of Strathclyde's Power Electronics, Drives and Energy Conversion research group researches and develops novel and innovative power electronics circuits. The range of applications extends from the low-power, low-noise circuits investigated in this TTOM research award, to high-power multi-MW converters for the integration and control of renewable and distributed energy resources.

Objectives

The objectives of this research award were to design, build and assess a novel class of DC-DC converters for ultra-low-noise power supplies. In this research two novel approaches were applied. The first uses an innovative winding technique for the multi-output transformer used in the DC-DC topology. The second uses a combination of current- and voltage-slew-rate limiting to reduce the harmonic noise on the output voltage. This would be assessed through analysis, simulation and experimentation. An MPhil student worked with Wound Magnetics to design, fabricate and test the novel DC-DC converter circuitry.

Conclusions

The research work realised a practical DC-DC converter that displayed excellent noise performance. The output ripple voltage was 0.015% of the 3.3V rail – under 1mV peak-peak ripple. The circuit performance was within the range predicted through analysis and simulation. Further enhancements to the design of the converter have been identified, and these are currently being evaluated at the University of Strathclyde with an ongoing collaboration with Wound Magnetics.

The TTOM award has successfully fostered an SME-academia relationship that has assisted the SME in developing new product and commercialisation opportunities. Wound Magnetics and the University of Strathclyde are currently in the process of seeking additional support to commercialise the novel converter topology and control techniques.

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