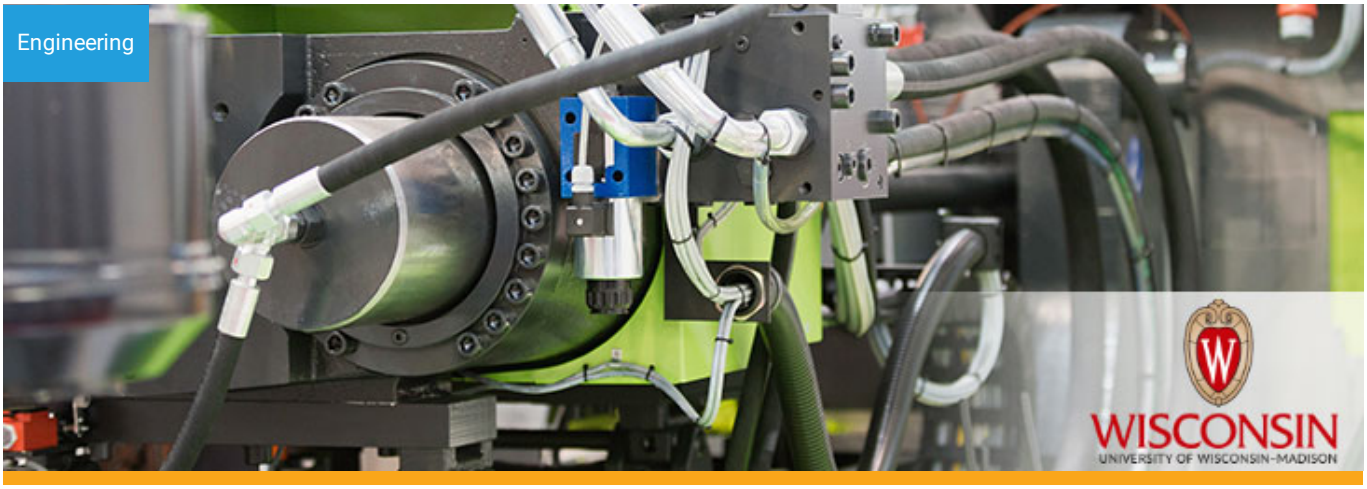

Integrated Capacitor, Inductor and Resistor for Use as a Power Converter Filter

View U.S. Patent No. 10,381,897 in PDF format.

WARF: P170329US01

Inventors: Daniel Ludois, Andy Schroedermeier

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a novel bus bar design with integrated voltage rise time filter to protect against damaging voltage fluctuations.

This innovation represents an advancement over existing technology by integrating what is currently a separate, large and bulky filter component into existing components of an inverter system. This integration may save weight, volume and/or cost compared to other approaches.

Overview

High-power electrical equipment such as electrical motors are increasingly powered using alternating current (AC) synthesized using semiconductor devices. Desirably, the semiconductors are operated in a switched mode, switching extremely rapidly between an *on* and *off* state to reduce power dissipation.

The power generated by switched semiconductors may have substantial high-frequency components caused by the rapid switching. These high-frequency components, often expressed in a rate of change of the voltage applied to the motor (dV/dT) and termed “voltage rise time,” can damage motor insulation, causing premature breakdown, pitting and early bearing failure.

For this reason, additional filter components are positioned between the motor drive (synthesizing power for the motor) and the motor. However, the process of adding filter components is challenging given space and weight constraints.

The Invention

UW–Madison researchers have developed a bus bar incorporating voltage rise time filtration. The filter makes use of the inductance of the bus bar and is augmented by a surrounding layer of high relative permeability material. This material also provides multiple layers that provide a necessary filter capacitance and damping resistance. The result is a compact form factor bus bar that also provides high-frequency filtering.

This technology builds on previous work by the researchers, extending their concept of an integrated inductor/capacitor to include resistance, as well as packaging into bus bars or cables for easy use. These passive components are often the largest and bulkiest components in the power electronic converter, and integration of these components represents an opportunity to make more compact, efficient and cost-effective energy conversion systems.

Applications

- Voltage rise time (dV/dT) filters

Key Benefits

- Novel design conserves space and cost
- Suitable for use with current voltage rise rate standards
- Compatible with a variety of bus bar designs
- Simplifies installation

Stage of Development

Working prototypes.

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- Daniel Ludois

Related Technologies

- For more information related to compact, integrated inductor/capacitors see:
- P140216US01
- P150389US01
- Explore more power electronic and electric machine innovations developed by Prof. Dan Ludois.

Publications

- Schroedermeier A. and Ludois D.C. 2019. Integration of Inductors, Capacitors, and Damping into Bus Bars for Silicon Carbide Inverter dv/dt Filters. IEEE Transactions on Industry Applications, vol. 55, no. 5, pp. 5045-5054 doi: 10.1109/TIA.2019.2920596

Tech Fields

- Engineering : Power electronics & control systems

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842