



Lighter, Cheaper Multilevel Converter for Adjustable Speed Drives

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WARF: P140112US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new multilevel converter that requires fewer components and can operate off one DC input source.

Overview

An adjustable speed drive (ASD) is a power electronics device that controls the speed of machinery. These devices also save energy for industrial processes that require adjustable speed or controlling the flow from a fan or pump.

ASDs have replaced many conventional fixed speed drives in low power and low voltage applications (e.g., air conditioners, washing machines, etc.). For high power and medium voltage applications – such as industrial air compressors, water pumping stations, steel rolling mills, marine propulsion and renewable energy systems – the cost savings are even more significant.

ASDs would benefit from being able to use multilevel power converters, which are ideal for adjustable speed, medium voltage applications. Various converter designs are available, but suffer from high cost, oversized or complex components, insulation issues or limited output levels.

The Invention

UW–Madison researchers have developed a new multilevel converter design that does not require any extra capacitors, diodes or isolated voltage sources. This reduces costs, size and insulation requirements compared to conventional multilevel converters.

The new design is based on two multiphase inverters electrically coupled in series. The key feature is that they share the same input source (e.g., a single rectifier, DC grid or batteries). Other designs require separate isolated voltage sources. In this design, the output AC terminals of the inverters power different groups of machine windings, and the total output voltage is combined inside the machine without additional components.

Applications

- Medium voltage adjustable speed drives/motor drives
- Utility interfaces for renewable energy systems
- Flexible AC transmission systems (FACTS)
- Traction drive systems

Key Benefits

- Fewer components
- Cuts operating costs
- Inverters can be identical, which simplifies manufacturing, development and maintenance.



- Works across a wide range of voltage levels and power ratings

Stage of Development

Simulations and prototyping have been completed. The researchers estimate the new multilevel converter design could reduce overall costs by 20 percent.

Tech Fields

- [Engineering : Electric machines](#)
- [Engineering : Power electronics & control systems](#)

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