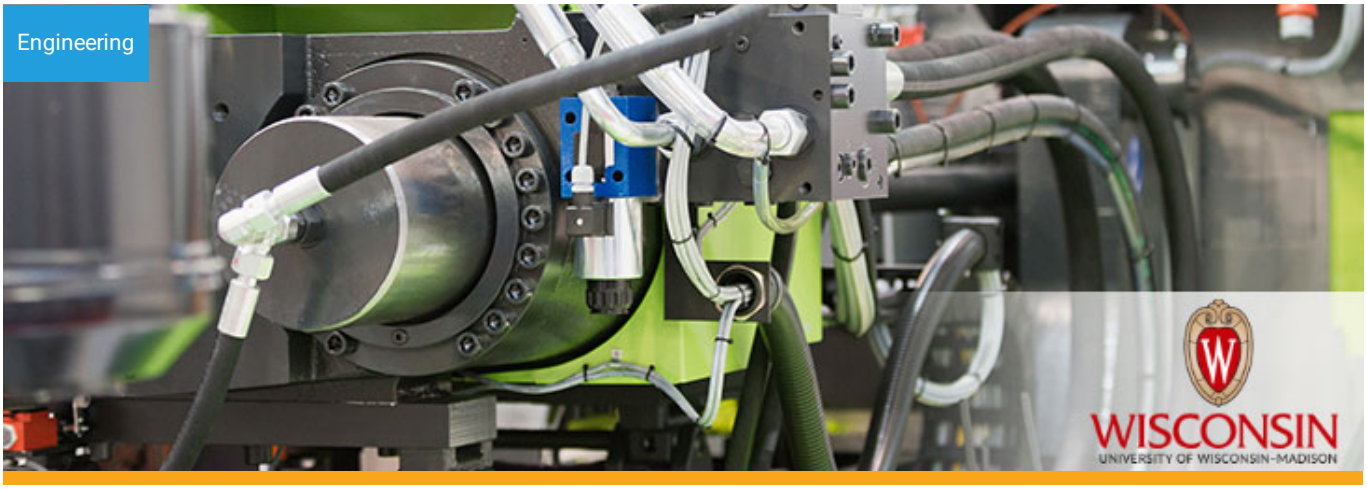
Engineering



Efficient Boost Rectifier Employing Half-Rated Semiconductor Devices

View U.S. Patent No. 7,006,366 in PDF format.

WARF: P04414US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a half controlled rectifier that can deliver performance similar to that of a fully-rated, three-phase, pulse-width-modulated (PWM) rectifier, while allowing the ratings of the switches and diodes to be reduced to half the rated power.

Overview

Rectifiers are devices that convert alternating current (AC) into direct current (DC). The simplest and least expensive type of rectifier uses a full- or half-bridge of diodes to convert single- or three-phase AC input power into DC power. Diode rectifiers can, however, introduce levels of harmonic distortion into the AC power system that exceed current guidelines, such as the IEEE 519 standard.

To address this limitation, rectifiers can include active switching devices connected in parallel with the diodes; however, the switches add significantly to rectifier's cost, especially since each switch must be able to handle the full-rated current and voltage of the system. As an alternative, rectifiers have been developed that are "half controlled," i.e., half the bridge is composed of passive diodes and the other half includes active switches. These systems are less expensive but show reduced efficiency and performance in comparison to rectifiers with a full-bridge of switches.

The Invention

UW-Madison researchers have developed a half controlled rectifier that can deliver performance similar to that of a fully-rated, three-phase, pulse-width-modulated (PWM) rectifier, while allowing the ratings of the switches and diodes to be reduced to half the rated power. Because the semiconductors devices need only be rated for half of the rectifier's peak current, they can be significantly less expensive than those used in conventional rectifiers. This rectifier also eliminates the typical problems seen in other half-controlled rectifiers, such as low-order even harmonics on both the AC and DC sides.

Applications

- High power HVAC applications

Key Benefits

- Has a unity power factor interface, putting it in compliance with the IEEE 519 standard
- Uses less expensive semiconductor devices than those found in conventional rectifiers
- Directly suited to high-power HVAC applications
- Could reduce the cost of rectifying alternative AC power sources such as wind farms, fuel cells and solar cell complexes
- Exhibits higher efficiency because switching losses in the semiconductor devices are nearly 16 percent lower than with a regular, six-switch configuration
- Rugged and shoot-through safe
- Eliminates need for dead-time compensation

- Uses simpler gate drive circuits than do fully controlled rectifiers
- Eliminates problems seen in other half-controlled rectifiers, such as low-order, even harmonics on both the AC and DC sides

Tech Fields

- Clean Technology : Solar, wind & water technologies
- Engineering : Power electronics & control systems

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867