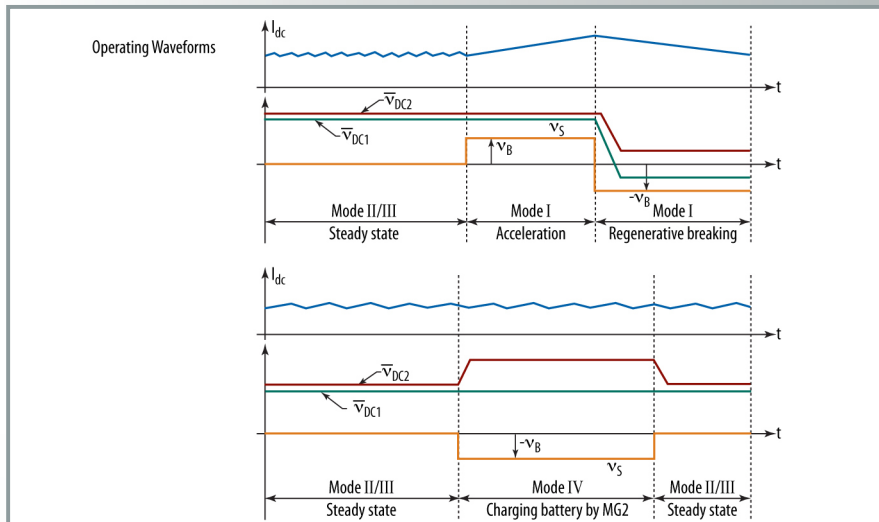


# Power Conversion Apparatus and Method for Hybrid Electric and Electric Vehicle Engines

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## Technology Summary

ORNL researchers developed a solution to power source problems in hybrid electric vehicle (HEV) and electric vehicle (EV) engines. These engines typically use voltage source inverters. The conventional type of converter requires costly capacitors, has trouble with high temperature operation, and is associated with a variety of other electrical problems.

These problems can be reduced or eliminated with the use of a current source inverter. The ORNL power conversion apparatus adds the ability to charge energy storage devices such as batteries, ultracapacitors, and fuel cells. The apparatus promises a significant reduction in inverter cost and volume, plus lower electromagnetic interference (EMI) noise emissions, increased reliability, a higher constant power speed range, and improved motor efficiency over the lifetime of the vehicle.

The apparatus includes an interfacing circuit that transforms the voltage source of energy storage devices into a current source that feeds direct current (DC) to the current source inverter. This makes it possible to maintain a constant DC bus current. More importantly, the interfacing circuit also enables the inverter to charge the batteries and ultracapacitors during dynamic braking, without needing to reverse the direction of the DC bus current.

## Advantages

- Reduces inverter cost and volume
- Lowers EMI noise emissions
- Increases reliability and improves motor efficiency
- Bulky, costly DC bus capacitors and antiparallel diodes in the switches are not required
- Tolerates phase leg shoot-throughs
- Provides sinusoid-shaped voltage output to the motor
- Boosts output voltage to a higher level than the source voltage

## Potential Applications

- Electric motors in EVs and HEVs
- Electric motors in industrial drive applications

## Patent

Gui-Jia Su, *Power Conversion Apparatus and Method*, U.S. Patent Application 12/399,486, filed March 6, 2009.

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