



Reducing DC-DC Converter Loss for More Efficient Cars

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing loss optimization control for the DC-to-DC converters found in vehicle power systems.

Overview

DC-DC converters are used in a variety of devices to raise or lower voltage. They are used in the power systems of hybrid and electric vehicles to boost the battery's output voltage. In these systems, an upper controller continually samples and determines the motor's target output in response to speed and the position of the accelerator pedal. For a motor outputting several tens of kilowatts, sampling time (T_a) is typically every 0.1 seconds.

Since efficiency is particularly important in hybrid and electric vehicles, the efficiency of the DC converter is critical too. Some amount of energy loss always takes place. Minimizing loss would mean a car could be driven longer on a tank of gas or battery charge.

The Invention

UW–Madison researchers have developed a technique for reducing loss in DC-DC converters by estimating and selecting the best flux linkage trajectory to meet target output. This is accomplished rapidly, within the time it takes to sample the system at large (T_a).

The loss associated with each of the possible trajectories can be stored in the converter controller or may be calculated in real time. The trajectory with the least loss is selected and implemented using a deadbeat control law, which can accurately achieve the loss minimizing flux linkage trajectory.

Applications

- Improving DC-DC converters in vehicles

Key Benefits

- Makes cars more efficient
- Control system update is simple.
- Inexpensive and easy to implement
- No hardware additions or extensive redesigns

Stage of Development

In experimental setups, loss differences of 4.4 percent (200-250 volts) and 2.8 percent (400-450 volts) were observed. Savings of 1 percent difference is considered a significant improvement for automakers.

Tech Fields

OK



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

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