INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Very Fast Power Converter Architectures

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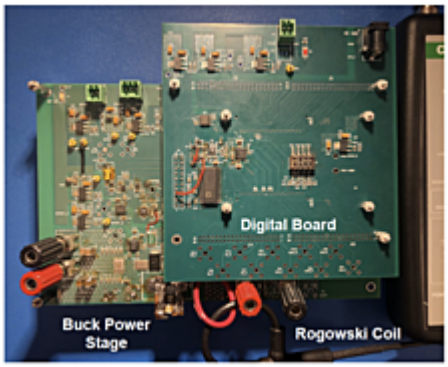

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Hardware
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OVERVIEW

A variable frequency DC/DC power converter

- Facilitates cycle-by-cycle digital control in the 5s framework
- May achieve fast transient responses without high-speed sampling hardware

BACKGROUND

Dynamic voltage scaling (DVS) is a technique that is employed in electronic systems to adjust the operating voltage of devices in response to variable power requirements. DVS proves important when supporting efficient operation of systems with rapidly fluctuating power demand, such as would exist in the automatic power control of light direction and ranging (LiDAR) systems used for autonomous ground and airborne vehicles. LiDAR systems require precise measurements of distance and speed to direct autonomous navigation, and they therefore consume a significant amount of power. The ability of DVS to enable LiDAR systems to operate efficiently may be challenging in boost converters, which are commonly utilized to power LiDAR systems due to their more complicated dynamics. Power DC/DC converters are commonly implemented to manage these interactions, though existing iterations are limited in both the range of voltages and frequency they can be altered. As such, a need exists for improved DC/DC converters that negate these limitations.

INNOVATION

Researchers have invented a variable frequency DC/DC power converter which facilitates cycle-by-cycle digital control in the 5s framework. This innovation is able to achieve fast transient responses without high-speed sampling hardware through event-triggered control and non-uniform sampling techniques. Additionally, the converter has a 3 MHz peak switching frequency which has been proven to provide exceptionally fast dynamic responses over a wide operating

range. The stable controller is capable of supporting a 2.6s no-overshoot, large-signal transient response with a peal slew current that exhibits 11 times the steady-state average current. Industries that can benefit from the employment of rapid dynamic voltage scaling DC-DC power converters include photovoltaic power systems, offshore wind turbines, electric or hybrid vehicles, telecommunication power supply, on shipboard power systems, and in offshore petroleum or gas applications.