



Decentralized Interleaving of Parallel-connected Converters in DC Microgrids

IP Status: Issued US Patent; **Application #:** 15/973,161

First fully decentralized strategy for switch interleaving of parallel converters

A decentralized control architecture allows parallel-connected converters to achieve an interleaved state. The controllers monitor slight changes in local current to construct the pulse width modulation (PWM) carrier and adjust their response accordingly. The intrinsic electrical coupling between converters allows the converters to converge to an interleaved state with uniform phase-spacing across carriers without communication.

Leverages dynamics of nonlinear Liénard-type oscillators

Multi-phase power delivery architectures traditionally rely on a centralized controller to manage the pulse width modulation of the system to achieve minimal distortion. Because they rely on central logic, these systems are vulnerable to disruption. Furthermore, they are designed for a fixed number of converters, making them unsuitable for emerging applications such as DC microgrids that require plug-and-play functionality. This new approach results in more resilient systems since they do not have a single point of failure, and these systems can scale more rapidly as additional converters are added.

Phase of Development

- Proof of concept. Simulations completed.

Benefits

- Increased resiliency
- Rapidly scalable and customizable
- Consistently high load bus power quality

Features

- Fully decentralized strategy for switch interleaving of parallel converters
- Liénard-type nonlinear oscillators

Applications

- DC microgrids
- Data centers
- Telecommunications
- Power electronics; modeling, simulation and optimization of power electronics circuits
- Smart AC-DC systems, future grids

Technology ID

20180089

Category

Engineering & Physical
Sciences/Instrumentation,
Sensors & Controls
Software & IT/Algorithms

Learn more



"Researchers

Sairaj Dhople, PhD

Associate Professor, Electrical and Computer Engineering

[External Link](http://ece.umn.edu) (ece.umn.edu)

Brian Johnson

National Renewable Energy Laboratory (NREL)

Miguel Rodriguez

National Renewable Energy Laboratory (NREL)

Florian Dorfler

ETH Zurich, Professor

Publications

[*Decentralized Interleaving of Parallel-connected Buck Converters*](#)

IEEE Transactions on Power Electronics, 04 September 2018

Interested in Licensing?

The University relies on industry partners to further develop and ultimately commercialize this technology. The license is for the sale, manufacture or use of products claimed by the patents. Please contact us to share your business needs and licensing and technical interests in this technology.