MISSOURI S&T

Three-Phase Tapped-Inductor Buck-Based Dual Active Bridge Power Electronic Converter

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Opportunity

Seeking a licensing and development partner to advance this converter toward commercialization.

Development Stage

Validated through circuit simulation.

Intellectual Property

Provisional Patent Application In Preparation

Publication

Coming Soon

IDF#

26-MST-046

PROBLEM STATEMENT

High-power isolated DC-DC converters require a large step-down ratio for 800 VDC-to-48 VDC power supplies used in AI data centers, electric vehicles, and renewable energy systems. The three-phase dual-active-bridge converter is the standard isolated topology for this job. But achieving a high conversion ratio forces the transformer's turns ratio to increase. A higher turns ratio increases parasitic effects, makes the transformer harder to design, and lowers efficiency. Placing a separate buck converter ahead of the dual-active-bridge stage avoids this problem. But it adds components and cuts efficiency. Designers need a single-stage isolated converter that reaches a high step-down ratio without relying so heavily on the transformer.

SOLUTION

Researchers at Missouri University of Science and Technology developed a three-phase tapped-inductor buck-based dual-active-bridge converter. The design replaces the standard primary bridge with a tapped-inductor buck-based inverter. This primary bridge first steps the input voltage down to an intermediate DC voltage, then converts it into the high-frequency AC waveforms that drive the transformer. The same switches handle both jobs. Step-down and isolated power transfer occur in a single stage rather than two. Simulation of an 800 VDC-to-48 VDC design operating at 1500 W and 200 kHz matched the converter's governing equations, including the calculated intermediate bus voltage and the phase shift needed to reach the target output.

VALUE PROPOSITION

This converter helps designers of high-power isolated DC-DC systems achieve large step-down ratios without pushing the transformer turns ratio to impractical levels. It simplifies transformer design, lowers secondary-side current, and reduces conduction losses. These benefits apply to power electronics in AI data centers, electric vehicles, and renewable energy systems. Folding step-down and isolation into a single stage also cuts component count and shrinks the footprint compared with two-stage designs.