Ladder-Based Bridge Circuits

Tech ID: 34235 / UC Case 2025-333-0

BACKGROUND

Bridge circuits are employed in 80% of power conversion circuits, including DC-DC, DC-AC, and AC-DC converters.

They consist of complementary switches connected across a DC bus voltage that are used to generate a periodic rectangular signal from a DC signal, and vice versa. A current issue with bridge circuits is that increasing the breakdown voltage of a bridge circuit, whether by connecting N devices in series or via multilevel converter topologies, degrades its switching performance compared to that of the comprising field-effect transistors. Also, low-voltage devices offer lower switching losses compared to high-voltage devices for the same conduction loss, i.e., better switching figure of merit.

DESCRIPTION

Researchers at UC Santa Barbara have formulated a groundbreaking approach to bridge circuits used in power conversion, allowing electronics and semiconductor manufacturers to reach higher voltages with previously developed devices. By utilizing low-voltage semiconductor devices in high-voltage applications, these new bridge circuits maintain excellent switching performance while achieving higher voltages compared to single devices, overcoming the traditional trade-offs faced in power conversion circuits. Additionally, the circuits can effectively establish isolated and non-isolated switching and resonant converters with 10% higher efficiency compared to existing solutions.

ADVANTAGES

- Enables efficient power conversion within a small form factor
- Allows the voltage to be divided equally between the stacked bridges
- Creates higher voltages using existing devices without degrading their performance
- Allows low-voltage devices to be used in high-voltage applications without compromising their switching performance

APPLICATIONS

- Semiconductors
- Power electronics
- Power converters
- Integrated circuits
- Data centers

CONTACT

Pasquale S. Ferrari
ferrari@tia.ucsb.edu
tel: .

INVENTORS

- Salem, Loai

OTHER INFORMATION

KEYWORDS

circuits, bridge circuits, power conversion, semiconductor, electronics, energy storage, battery, microgrids, electric vehicle, data center

CATEGORIZED AS

- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2025-333-0

- Energy storage and battery management systems
- Electric vehicles
- Charging stations
- Shipboard microgrids
- Renewable energy sources and their interface to the grid
- Terrestrial microgrids

PATENT STATUS

Patent Pending

University of California, Santa Barbara
Office of Technology & Industry Alliances
342 Lagoon Road, ,Santa Barbara,CA 93106-2055 |
https://www.tia.ucsb.edu
Tel: 805-893-2073 | Fax: 805.893.5236 | padilla@tia.ucsb.edu