

ZVS/ZCS-Assisted Fully Soft-Switched Current Injection Circuit for Three-Phase Unfolding-Based AC-DC Converters

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Electrical and Computer Engineering

Abstract

In high-current AC-DC conversion networks, small inefficiencies lead to large losses and thermal issues. Current hard-switching circuits lose energy to heat every cycle. Certain components cannot operate at high temperatures, so the network potential is limited in these high-current circuits.

What It Is

A true soft-switching AC-DC converter with improved thermal and electrical efficiency.

Value Proposition

Through improved thermal efficiency, this invention allows for greater network sizes. Through improved electrical efficiency, this invention cuts energy costs and decreases carbon footprint.

Applicable Markets

Any market utilizing high-current AC-DC chargers: EV charging, data-center power, renewable-energy stations, etc.

Benefit

When hard-switching circuits are used at high power levels, significant heat is generated. At low power levels, thermal inefficiencies aren't costly, as less overall energy is generated. But at high power levels, this can generate enough heat to seriously damage system components, especially MOSFETs.

Additionally, electric vehicles are becoming more common and have increasing battery capacities. As high-capacity charging stations become more common, low-power AC-DC converters can be expensive to build and maintain at scale.

Using a true ZVS/ZCS-assisted approach, researchers at ASPIRE have found a method to convert between AC and DC with an even higher efficiency than contemporary chargers. Additionally, this soft-switching method is more thermally efficient, allowing for a cooler MOSFET module.

By improving thermal efficiency, this technology saves energy and enables larger networks at AC-DC conversion hubs.

Market Application

This technology finds its application in large-current AC-DC conversion circuits. In practice, this technology allows for even larger networks on the same circuit because of the improved electrical and thermal efficiency. This

includes markets like EV charging, data-center power, and renewable energy storage and production.

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Intellectual Property

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