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Zero Voltage Transitions in High Conversion Ratio Converters

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Background

Increasing power demands in renewable energy, transportation, and power supplies for IT are driving the need for efficient power converters capable of high conversion ratios. The power transformer has been the traditional component for high frequency power conversion. However, with advancements in fast switching converters that require nimble and vast frequencies for high power density, the power transformer has become a bulky and inefficient component. Other transformer-less components such as the High Conversion Ratio Converter (HCRC), have voltage and current overlaps leading to switching losses. High conversion ratio applications are driving the need for efficient transformer-less power converters.

Invention Description

Researchers at Arizona State University have introduced a circuit configuration for developing efficient transformer-less components for high power ratio conversion. This new configuration imports a zero voltage transition (ZVT) circuit into an HCRC to enable soft switching. Soft switching allows for the HCRC to convert high power ratios with minimal voltage and current overlapping, leading to negligible switching losses. Importing the ZVT comprises only of minimal set of single controlled switches and auxiliary inductors, regardless of the phases in an HCRC. The added ZVT circuit configuration also leads to efficient operation even at high switching frequencies leading to higher power density.

Potential Applications

- Replacement for Traditional Power Transformers
- Electric Vehicles
- Photovoltaic Cell Power Converter
- Fast Switching Devices

Benefits and Advantages

- **Powerful** – Conversion ratios exceeding 50 and switching frequencies in the MHz range are possible
- **Dynamic** – The configuration is capable of handling uni-directional and bi-directional power flows
- **Versatile** – The configuration is able to be applied to a large number of power converters