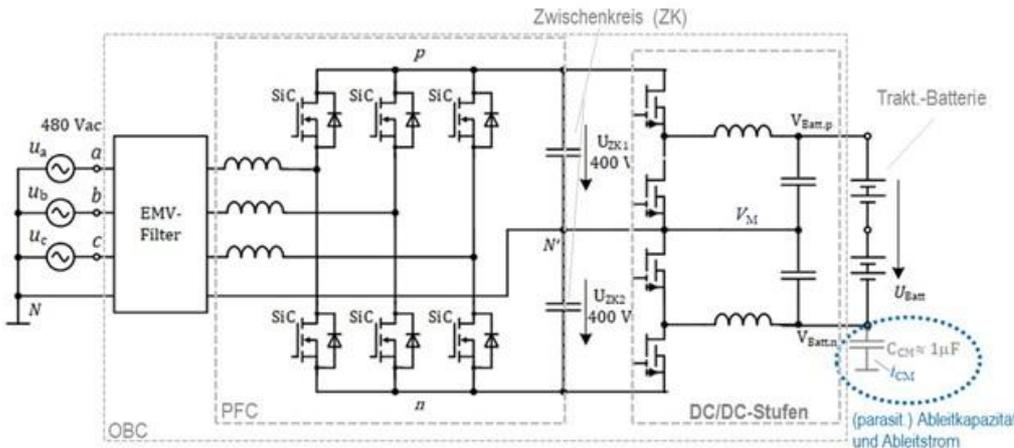


Compensating for Leakage

A DC-DC stage control mechanism for on-board chargers in EVs

Invention

The number of electric vehicles being registered is increasing significantly each year, with the efficient charging of the drive battery a key technology for the continued success of electric vehicles on the market. In this context, attention has recently turned to transformerless on-board charger



Circuit diagram for a transformerless on-board charger on a three-phase grid. According to the invention, the DC-DC stages already necessary also compensate for the leakage current i_{CM} .

concepts. Given the known and considerable leakage capacitance of the battery and the connected high-voltage system, special care must be taken with transformerless chargers to ensure that high leakage current is not generated to ground and through the PE conductor. The patent-pending invention from Paderborn University uses a method that does without an additional compensation circuit for leakage current, instead using the charger's inherent DC-DC stage that connects its link to the battery (see figure). This DC-DC stage makes it possible to effectively compensate for low-frequency pulsating battery potentials and the resulting unwanted leakage current, such as those that occur particularly with transformerless on-board chargers for electric vehicles on various AC grids. This has been proven to reduce leakage current considerably, even to zero.

Commercial Opportunities

All battery-based electric vehicles, whether all-electric or plug-in hybrid, could utilize this circuit in the future with a suitable control mechanism. All major car manufacturers and charging component suppliers are currently working on efficient charging concepts for electric vehicles in order to reduce charging time and costs (in material and electrical operating losses) and to increase range by, e.g., reducing weight.

Current Status

An application has been submitted to the German Patent and Trademark Office, with subsequent applications in other countries possible in the priority year. The simulation results are proof of concept for the technology and a prototype is planned for completion by the end of 2021. On behalf of Paderborn University, we are offering interested companies the opportunity to license and continue to develop this technology.

An invention of Paderborn University.

Competitive Advantages

- Simple circuit concept
- No additional components
- Compatible with international AC grids (1AC, 2AC, 3AC)
- Excellent leakage current reduction

Technology Readiness Level

123456789
Experimental proof of concept

Industries

- Power electronics
- E-mobility
- IT/industrial power supply
- UPS

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