



EMC Professional Talk

M. Sc. Jens Aigner

**Arbeitsgebiet Bordsysteme (On-board Systems Lab),
TU Dortmund, Germany**



Broadband Active EMI Cancellation with Adaptive Filters using Delay- Compensated Gate Control Signals

Due to advances in power transistor technologies, such as wide-bandgap semiconductors, faster switching frequencies and steeper switching slopes are used in power electronic systems to achieve higher efficiency and power density. This trend poses a challenge for the EMC of power electronic systems, resulting in large and heavy passive filters that can take up a significant amount of space in the entire system. In order to reduce volume and weight of passive filters, active EMI filtering methods may be used. However, these methods can suffer from systematic propagation delays, which deteriorate the active filter performance, especially at higher frequencies.

In this talk, an alternative approach, using adaptive digital filters, will be discussed. This method takes advantage of the direct relationship between the transistor switching pulses and the resulting disturbance pulses for common mode EMI. This allows for a calculation of a suitable cancellation pulse based on the switching pulse of the transistor. To compensate for the latency of the cancellation signal generation, a small delay (~100 ns) is added to the digital gate control signals before the gate drive circuits.

The proposed concept will be elaborated in detail. In addition, the derived requirements on power electronic systems will be presented, which will then be used to analyze the applicability of the method to a motor inverter system. The results with the motor inverter will be discussed and an outlook on further improvements of the method will be given.

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About the speaker:

Jens Aigner received his B.S. and M.S. degrees in electrical engineering from TU Dortmund University, Dortmund, Germany, in 2020 and 2022, respectively. From 2020 to 2022, he was a student assistant and thesis student with the On-board Systems Lab at TU Dortmund University in Germany. There, he has worked on active EMI cancellation in power electronic systems using adaptive filters. From March 2023 to April 2024, he was a power electronics engineer for bidirectional BEV charging technologies with KOSTAL Group in Dortmund, Germany. Since May 2024, he is a research assistant and doctoral student with the On-board Systems Lab at TU Dortmund University.

Organization:

Dr.-Ing. Miroslav Kotzev, Rohde & Schwarz GmbH & Co. KG
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