



30 Sept. & 1 Oct. 2025

Graz, Austria

### Submission to the Call for Presentations and Posters

(please save as pdf and upload your document via the [submission form](#) by 12 May 2025)

<b>Corresponding topic</b> (please tick)	<input checked="" type="checkbox"/> Power Electronics in Automotive & Charging Applications <input type="checkbox"/> Power Electronics in Medium Voltage Applications <input type="checkbox"/> DC Industry <input type="checkbox"/> Sustainability & Circular Economy in Power Electronics
<b>Proposed presentation title</b> (you can indicate a preference for oral or poster presentation in the submission form)	Early-stage simplified conducted EMI simulations framework for automotive motor inverter applications
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#### Abstract

Electromagnetic interference (EMI) is a critical concern in automotive power electronics, where inverters must comply with challenging industry standards for conducted emissions. Early-stage assessment of EMI filter design is essential, as filter choices significantly affect the bill of materials (BOM) and overall volume of the inverter and hence of the whole system. However, at the initial design phase – before PCB routing and 3D parasitic extraction are possible – engineers face a trade-off between simulations accuracy and available design data.

This study presents a practical workflow for forecasting conducted EMI behavior in automotive inverters at the concept stage. The method consists on Spice simulations workflow using both transient analyses to get differential mode (DM) and common mode (CM) excitations and AC domain analysis to tune the filter and understand the interaction between components. Simplified circuit models of component parasitic behavior are used, based on available data, such as motor impedance characterization or parasitic data from components datasheets. It allows to estimate key elements and predict resonant interactions, particularly between the common-mode choke (CMC) and motor impedance. Although simulation assumptions at this stage have an impact on results accuracy, the approach enables identification of critical resonance risks and provides insights on how to mitigate it on the final design, without a complete redesign.

The paper is structured in three mains parts. First, the conducted EMI simulations framework is detailed step by step, as described in Fig. 1. Then, parasitic behaviors modeling is discussed (Fig. 2) with a mix between theoretical and measured data (see motor impedance characterization setup illustrated in Fig. 3)Fig. 2. In the last part, simulation results are discussed based on different modeling assumptions, for instance assuming different connection path for the  $C_y$  capacitors (Fig. 4). Finally, a conclusion is given on how the proposed methodology allow an early BOM estimation in order to facilitate the design of an EMI-compliant inverter.

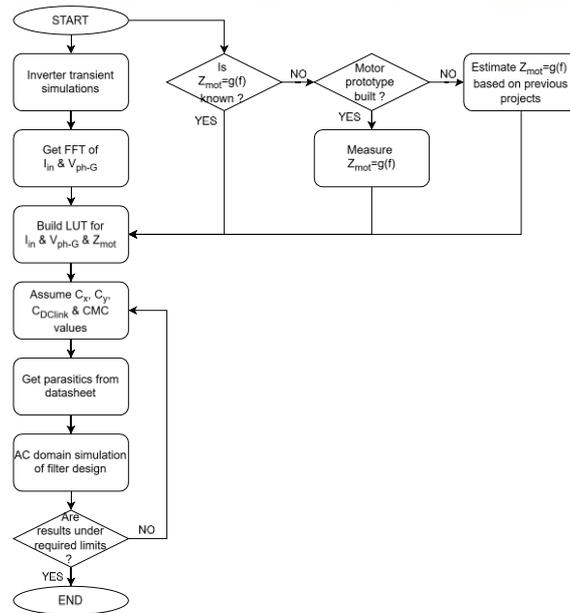


Fig. 1: Framework of the EMI assessments during early-stage design

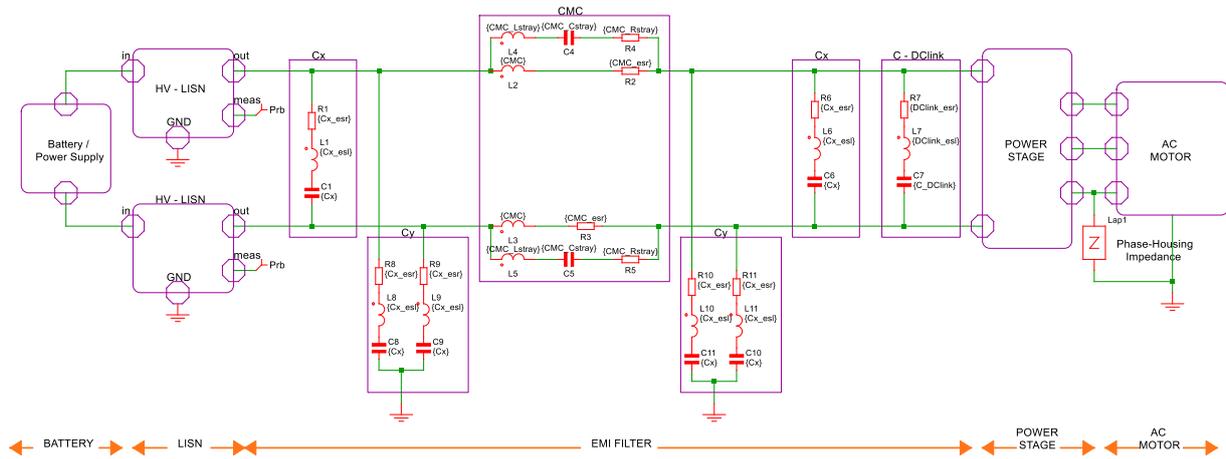


Fig. 2: Schematics of the EMI filter structure used in motor inverter application

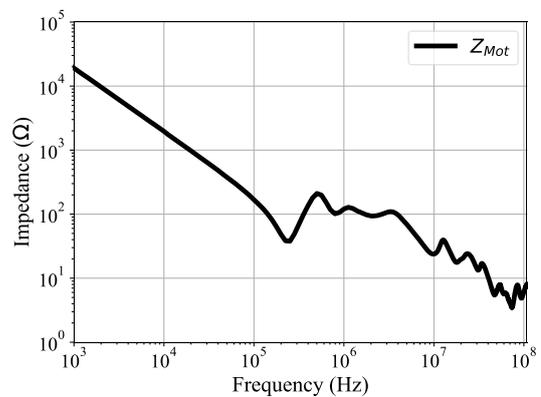
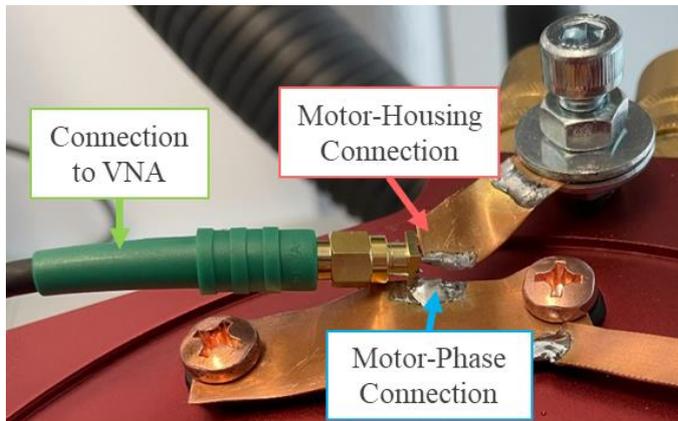


Fig. 3: Characterization of motor impedance – setup (left) and measurement results (right)

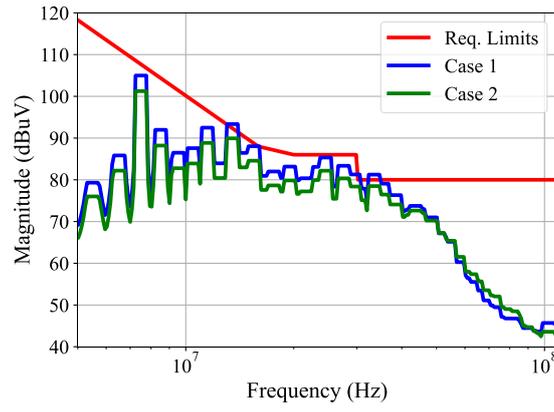


Fig. 4: Simulations results with same  $C_y$  connection (case1) or separate connection (case2) – zoom between 5MHz-108MHz

# ABSTRACT

## SYMPOSIUM POWER ELECTRONICS FOR ENERGY TRANSITION



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<b>Short CV</b>	<ul style="list-style-type: none"><li>• Master degree in Electrical Engineering from Grenoble INP-UGA, Grenoble, France, in 2017.</li><li>• Ph.D. degree in Electrical Engineering from HESAM University, Lille, France, in 2023.</li><li>• From 2017 to 2024, was with Moving Magnet Technologies, Besancon, France, as a R&amp;D Engineer in electronics department. Main works were on developing electronic board including control of small electric actuators (below &lt;1kW).</li><li>• From 2024, is currently a R&amp;D Engineer at Compact Power Motion GmbH, Munich, Germany.</li><li>• Research interests include power electronics design and simulations, as well as design methodology for power mechatronics systems (5 kW- 100kW) design.</li></ul>	
<b>Photo</b>		