Subject:

NUMERICAL METHODS AND TOOLS

TO TAKE INTO ACCOUNT CAPACITIVE EFFECTS

IN THE EMC MODELING OF POWER ELECTRONICS DEVICES

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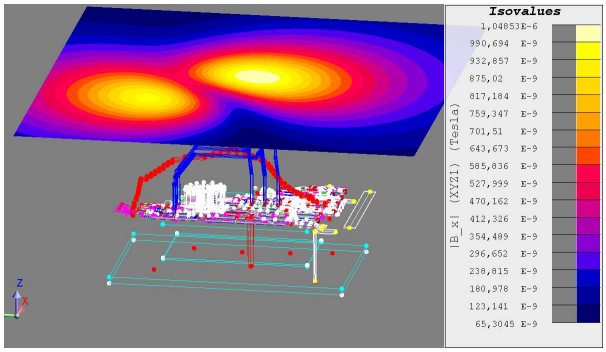
Abstract:

Given the increasing complexity of static converters present in any electrical system, design engineers need tools for electromagnetic modeling of incr easingly powerful, especially concerning ElectroMgnetic Compatibility (EMC). The objective of this work is taken into account in the form of parasitic capacitances, the electrical coupling in high frequency in the EMC modeling of power electronics devices.



Several integral formulations based on the Moment Method, and the Adaptive Multi-Level Fast Multipole Method have been developed and validated for the extraction of equivalent capacity. This last method, which speeds up the computation times while limiting the memory space required (no full matrix storage), has been adapted to the problem to ensure the most accurate results linked to the mesh. A prototype of this algorithm has been integrated into the software InCa3D, based on the PEEC method, allowing to build an equivalent circuit composed of lumped elements in which capacitive effects are coupled to the resistive and inductive model of the structure.

Several test cases, from the literature or industrial applications, have been simulated by using these equivalent circuits, either in a circuit solver or in InCa3D in order to evaluate their conducted and radiated EMC performances. Finally, comparisons made with measurements gave good results and thus validate the proposed approach. Such a strategy can easily be part of any type modeling system because it allows the treatment of complex industrial devices over a wide frequency band with a lightweight model.