Hyundai Mobis Automotive Group Improves the EMC Analysis Process from 2D to 3D Using Feko for Shielding Effectiveness Simulation

Customer Profile

Affiliated with Hyundai Motor Group, Hyundai MOBIS produces core automotive components. Its wide range of products includes modules (chassis, cockpit, front-end-modules) and many automotive parts for customers' convenience and safety. Hyundai MOBIS provides modules mainly to Hyundai and Kia companies, and it is expanding its business to other auto makers worldwide.

Challenge

Solving time reduction and improved efficiency in results

Shielding enclosures are employed to protect against illumination from both external fields and electromagnetic (EM) leakage from electronic products, and hence they help to meet the electromagnetic compatibility (EMC) requirements. However, the integrity of these enclosures is often compromised by apertures and slots used to accommodate visibility, ventilation or access to interior components. Such openings allow exterior electric and magnetic fields to penetrate into the interior space, where they may couple to Printed Circuit Boards (PCBs). Thus inducing currents and voltages on interior conductors. It is important to know the EM shielding effectiveness of shielding enclosures in the presence of these apertures.

Solution

Hyundai MOBIS analyzed the problem from a PCB level to a system level, including the shielding effectiveness for the current design of the Around View Monitor (AVM) housing. At a PCB level, once the AVM PCB design done by the Design Group was available, simulations related to signal and power integrity were done. The analysis of resonances, impedances, characteristic impedances, simultaneous switching noise and DC IR drops permitted to identify power issues. Solutions were adopted to fix such issues so to meet the required standards and regulations. Some of the adopted solutions were related to changing the value of capacitors or to changing the structures of the ground planes to reduce loop inductances. With respect to signal integrity, eye view analysis were done at higher frequencies for DDR2 and USB communications. Some issues were observed, such as overshoots and undershoots. Such issues were solved by fine tuning the value of either series resistors or drivers' terminations.

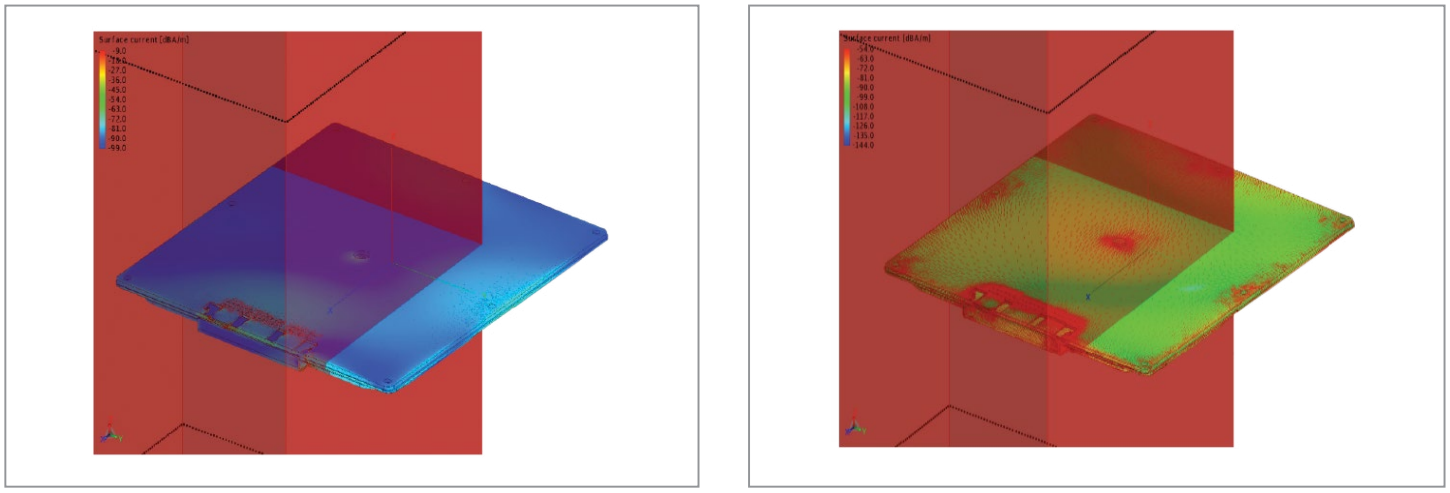
A system level analysis was carried out using FEKO® so to also analyze the effect of the material of the AVM housing on its shielding effectiveness, something important to reduce the level of electromagnetic interferences generated by the board.

The workflow that was followed to import the near fields around the board into FEKO was the following: firstly, the near fields around the PCB were calculated with Sigrity analysis tools from Cadence and exported to the .nfd file format. Secondly, the near fields in .nfd format were imported into FEKO. From such fields FEKO creates an equivalent source for the PCB. This approach is known as model decomposition. With such source already available in FEKO the CAD file related to the AVM housing was also imported into FEKO so to perform a 3D analysis and the simulation of the shielding factor of the housing used for the AVM.

"FEKO gives me a very high level of confidence and allows me to solve 3D Electro-Magnetic Compatibility(EMC) issues faster."

Imran Shaik,
Manager, EMI/EMC Division, Hyundai MOBIS

Around View Monitor(AVM) is a support technology that assists drivers to park more easily by better understanding the vehicle's surrounding through a virtual bird's eye view from above the vehicle. It helps the driver visually confirm the vehicle's position relative to the lines around parking spaces and adjacent objects, allowing driver to maneuver into parking spots with more ease.

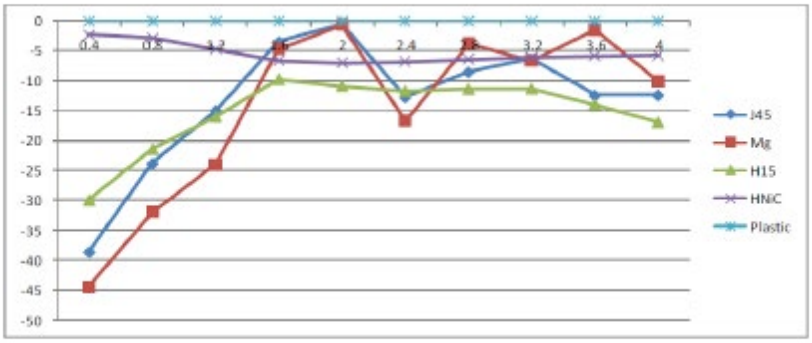


3D Analysis: FEKO simulation of surface currents on the AVM unit using PCB equivalent source inside

Results

With FEKO, Hyundai MOBIS simulated the surface currents of the assembly consisting of equivalent source and AVM housing at several frequencies from 0.4 GHz to 4 GHz. Such analysis permitted to get a better understanding of the hotspots on the enclosure. At the areas around the slots and the central mounting holes current densities were higher. By adjusting the width of the slots and connectors such hotpots were reduced or even eliminated.

Different composite materials were possible for the housing. With FEKO several analysis were done to analyze the effect of each material on the shielding effectiveness and thanks to this study the material providing the desired shielding factor against frequency was selected. Regarding materials, Hyundai MOBIS is developing new ultra-light materials in order to meet requirements for better fuel efficiency, performance, product appeal, reliability and sustainability.



3D Results: Comparison of simulated shielding effectiveness (dB against frequency in GHz) for different possible materials for the housing of the AVM unit

Benefits

By following a system level approach, based on model decomposition and 3D analysis in FEKO, Hyundai MOBIS could save 33% of the simulation time while keeping the accuracy. Also, FEKO results permitted to select the best composite material in terms of shielding effectiveness.