Investigating Electromagnetic Susceptibility of Cables and Electronics Enclosed Within a Complex Platform

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The purpose of this paper is to analyze the electromagnetic compatibility (EMC)/electromagnetic interference (EMI) of external energy pulse and its impact on a multi-scale and complex system. The system includes electrically large metallic platform, as well as electrically small cable-interconnected antennas and shielding enclosures. In addition, multiple antennas are mounted on the platform for wireless communication.

The accurate simulation of high-power microwave (HPM) with very short rise time and intense energy pulse and the field penetration into this multi-scale system are of vital importance. When the pulse hits the platform, field penetrates inside through apertures by front door and back door coupling. If the incident pulse has strong frequency spectrum component at the resonant frequency of the cavity structure, then the field intensity inside the platform will accumulate after a few pulse trains and couple through the cables to electronics.

In this work, we analyze the electromagnetic susceptibility of the cables and electronics within a complex platform by using non-conformal domain decomposition method (DDM). Such multi-scale EMC problems are extremely challenging and tax heavily on existing numerical methods. Specifically, we employ a multi-solver DDM strategy and separate the perfect electric conductor (PEC) enclosures from the antennas and cables. An integral equation discontinuous Galerkin (IEDG) solver is adopted to compute the field penetration due to the external shell with the apertures. A surface integral equation DDM (SIE-DDM) is used for both homogeneous object and composite penetrable scatterers (eg. antennas and cables with insulators). The boundary value problems of these separate regions are coupled to each other through the Robin transmission conditions, which are prescribed on the region interface (eg. cable connectors/loads).