Source Reconstruction using Fast Array-Based Near-Field Measurement

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1. Extended Abstract

The methods for measuring radiated emissions from electronic products to ensure they pass various standards are well defined and straightforward but are also time consuming and require expensive infrastructure. To reduce the risk of failure at the compliance stage many companies will implement simulation of the designs. The ability of software to predict the emissions from simple structures is well established but as designs become more complex even modern software fails to make predictions accurately. This may be caused by level of detail of the smallest components like ICs or for a simple lack of knowledge of the underlying detail inside proprietary components of the design.

Both of these problems could be overcome if the component or section of the PCB that is unable to be simulated could be replaced by an equivalent source which contained enough relevant information. One solution for this is to use measured magnetic field data in the near field and recreate an equivalent source [1]. This method has evolved from planar reconstruction to reconstruction on a Huygens's box [2] but in all cases the capture of this near field data requires slow and expensive equipment. Using an array of probes would speed up the data capture significantly and the existence of existing commercial equipment that captures both amplitude and phase means the cost to setup new systems is low. The business value of this hybrid fast scanning and source reconstruction method would be significant as it provides the ability to analyze and diagnose circuit behaviors long before system designs are finalized .The benefit of the array of probes comes with the problem of the interactions between the ground plane behind the probes and the device under test. In retrospect different approaches have been used to try source reconstruction. Early attempts are originally based on Fourier transform [3]. Second class of attempts use Method of Moments to reconstruct fields and instruction of fictitious boundary conditions [4] and more recent works rather use case specific simplified models suitable for certain reconstruction applications as PCBs and ICs [5]. This paper proposes to combine fast array based near field measurements along with a novel fast source reconstruction technique that filters out the effect of emissions from a ground plane representing the probe array. In the proposed technique, measured magnetic fields get back-projected to a fictitious layer and a ground plane simultaneously. Then the back-projected currents on the fictitious layer are used for diagnosis and near-field to far-field transformation purposes. Moreover, different approaches on this path get compared. The approaches may differ on the type of integral equation they use, the way they model the fictitious layer and the type of basis function they exploit. It is quite interesting and useful comparing the ability of different source-reconstruction algorithms in rejecting the effects of ground plane in fast array based measurements. Conducting this comparison could provide us with the knowledge by means of which we can optimize our approach to address case specific (PCB/IC) as well as general EMC/EMI issues.

2. References

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