Network Oriented Modeling of EMI Sources

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Abstract

The near-field measurement is one of the widely used methods of complex device electromagnetic compatibility (EMC) analysis. The device radiation pattern can be calculated directly using the near-field measurement or after the reconstruction of equivalent dipole model in the object plane [1]. In accordance with equivalence principle the dipole model parameters completely determine the current distribution in the object surface. In the case of a planar structure such as Printed Circuit Board (PCB), these currents characterize the physical trace of signal transfer and conversion. Thus, the resulting dipole distribution can be used not only for the calculation of electromagnetic field at any space point, but also for the synthesizing of a simplified network oriented model of EMI sources inside the device under test (DUT). One of the possible modeling approach is the reconstruction of the structure external characteristics into the equivalent electrical circuit consisting of lumped elements (resistors, inductors and capacitors) and coupling elements, for example ideal transformers or delay lines [2]. This approach allows determining the conversion of a known input signal in the structure elements as well as its radiation characteristics. The presented model also makes it possible to find an equivalent circuit of the correction scheme that can be used for the reduction of transmission losses and minimization of spurious emissions.

In this paper the EMI sources equivalent circuit synthesis based on the electrical dipole model is discussed. The generalized Brune method [3] is used to determine the multiport equivalent network. To estimate the parameters of system functions the Vector Fitting Method [4] is applied. The equivalent electrical circuit synthesis procedure based on the full-wave modeling of the electromagnetic structure is presented.

8. References

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