An Iterative Least-Square Based Technique for High Resolution Source Reconstruction with Phaseless Near Field Scan Data

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Due to continuous increasing operating frequency and shrinking component scale, considerable attention has been drawn to electromagnetic interference (EMI) and signal integrity (SI) problems in microelectronics. To solve these problems, near field scan (NFS) is adopted to locate radiating sources on devices under test (DUT). During the NFS process, ultra close-to-surface scan is required to enhance the resolution of scanned images due to the evanescing nature of electromagnetic fields. To compensate for the evanescence effect, recently inversion techniques have been employed. Inversion methods consider the radiating model of DUTs and reconstruct radiating sources based on scanned fields. The advantages of inversion methods including more flexibility for scan height and higher resolution on reconstructed images. However, conventional inversion methods require both magnitude and phase information of scanned fields. Obtaining phase information of near fields will dramatically increase the complexity and/or time of a NFS process. One possible way to overcome this problem is to utilize only the magnitude of radiated fields during inversion process. Unfortunately this attempt will result in solving a set of nonlinear equations which significantly increases the computational complexity of this problem.

This work proposes an iterative least-square based technique that can reconstruct sources on DUTs without the needs for phase information of its radiated fields. This method searches for the solutions that approximate magnitudes of scanned fields. However, instead of forming a nonlinear system, this method leads to a linear system with the help of Taylor expansion. Therefore, iterative methods can be used to obtain least-square solutions to the newly formed linear system. Examples including synthetic and experiment data show competitive advantages of this method over conventional inversion methods when only magnitude information of scanned fields is available. Detail information on algorithm as well as examples that demonstrates the effectiveness of this method will be presented.