Multi-Conductor Electromagnetic Coupling Model for Sensitive Wires Subject to Driven Wire in Complex Electronic Systems

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Abstract

A novel multi-conductor electromagnetic coupling model for the sensitive-wire subject to driven wire in a high-precision machining workbench is proposed in this paper. The general coupling model for an N-wire system is derived and is used to evaluate the wire coupling effect. Furthermore, 4-wire and 3-wire models are demonstrated to verify the accuracy through full-wave electromagnetic simulation below 10 MHz. The results show that the error between the proposed method and the full-wave electromagnetic simulation is less than 10%, demonstrating the high efficiency and accuracy of the proposed method. When the parameters of the driven power wire and the most sensitive wire are fixed and the parameters of neighboring wires are swept, the maximum fluctuation of the induced current on the most sensitive wire is 6.1 dB. The efficient calculation method proposed in this work helps reduce the risk of electromagnetic interference in complex electronic systems and improves the design efficiency of wires. It is promising to become a high-performance method with high efficiency and precision.

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