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基于克朗方法和随机耦合模的腔体耦合统计性预测

摘要

本文提出了一种基于克朗方法的腔体孔缝耦合模型，适用于带矩形或圆形孔缝的矩形腔体在外部入射电磁脉冲时，求解内部屏蔽效能或内部端口耦合强度。根据外部入射电磁波情形下腔体波导传输特性以及孔缝特性，建立起干扰源-孔缝-腔体外壳的克朗-布朗宁拓扑模型，建立起张量方程并进行计算。同时还将此方法与随机耦合模结合起来，使其拓展到可以应用于预测腔体内为波混沌状态下时，内部端口耦合电压的概率分布情况。设计并搭建了波混沌腔体实验平台，通过实验结果验证了此方法的有效性。

关键词

孔缝耦合；高功率微波；克朗方法；随机耦合模

Abstract

This paper proposes a cavity aperture coupling model based on the Kron's method, which is applicable for evaluating the internal shielding effectiveness (SE) or internal port coupling strength of a rectangular cavity—featuring either rectangular or circular apertures under external electromagnetic pulse incidence. Based on the waveguide propagation characteristics and aperture properties under external incidence, a Kron-Branin topological model encompassing the interference source, aperture, and cavity enclosure is established to formulate and solve the corresponding tensor equations. Furthermore, by integrating this approach with the Random Coupling Model (RCM), the method is extended to predict the probability distribution of coupling voltages at internal ports when the cavity is in a wave-chaotic state. Finally, a wave-chaotic cavity experimental platform was designed and constructed, with experimental results validating the effectiveness of the proposed method.

Keywords

Aperture coupling；High power microwave；Kron's method；Random coupling model

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