Characteristics of Common Mode Currents of Unbalanced Transmission Lines Crossing a Rectangular Aperture in a Backplane

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Abstract—This paper presents the characteristics of a common mode current for a two-wire transmission line crossing a rectangular aperture in an infinite ground backplane. The transmission line has a different length. The finite difference time domain (FDTD) method is used to determine the characteristics of the common mode current as a parameter with the transmission line spacing and additional wire length. Comparisons with common mode current measurements were also made to verify the numerical calculations.

Keywords-component; unbalanced transmission line; common mode current; backplane)

I. INTRODUCTION

Modern electrical and electronic systems incorporate a large number of digital devices packaged in separate units interconnected by cables[1]-[2]. The EMI radiation resulting from magnetic-field coupling along the wires. In this paper, the characteristics of common mode currents at the end of the transmission lines were calculated by the FDTD method. To verify the theoretical analysis, the calculated common mode currents are compared with experiments.

II. THEORETICAL ANALYSIS

Fig. 1 illustrates a coordinate system of two unbalanced transmission lines surrounded by the infinite ground plane.

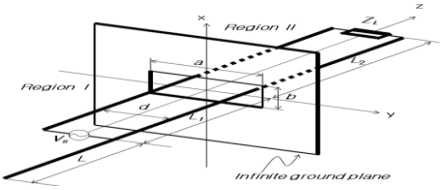
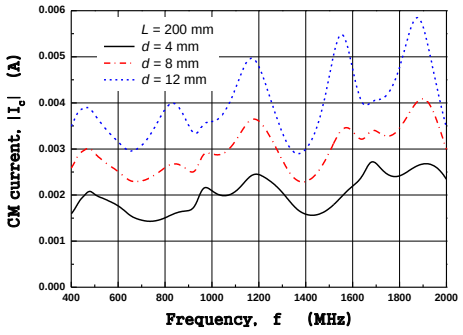


Figure 1. Unbalanced transmission lines crossing a rectangular aperture in an infinite backplane.



(a) L= 200 mm

Figure2. Frequency characteristics of common mode currents as a parameter of the transmission line spacing.

As shown in Fig. 3, the amplitude of the common mode current increases with increasing the transmission line spacing increases.

III. CONCLUSIONS

This paper analyzed the characteristics of common mode currents of the unbalanced transmission line crossing through a rectangular aperture in the backplane. It was shown that when the transmission line spacing increases the common mode current also increases. The transmission line spacing affects the strength of the increase in the common mode current than additional length of the transmission lines.

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