ON THE EFFECTS OF PROPAGATION PATH ON RF SIGNALS IN SYSTEMS

A. Q. Martin*
Holcombe Department of Electrical Computer Engineering
333 Fluor Daniel EIB
Clemson University
Clemson, SC 29634-0915, USA

The influence of the transmission path on the shape and magnitude of a RF signal as it passes through a system is of importance in an investigation to discover how the performance or output of digital circuits might be altered as a result of electromagnetic energy being incident upon, and propagating through, a system. If an RF signal of a specified form enters a system at a given point, it is desirable to determine the salient features of the signal at some other location within the system, where a susceptible digital circuit might be located. Moreover, it is useful to know if these features are primarily those peculiar to the entering signal, or if they are greatly influenced by the properties of the transmission path. Addressing these issues should help one gain some appreciation for the nature of a spurious signal arriving at the input of a digital chip deeply embedded in a complex system that is subjected to high-power RF excitation originating from outside the system proper.

Questions about the influence of the transmission path on the waveshape and magnitude of possibly deleterious signals can be answered by determining the nature of signals which propagate through cascaded coupled cavities that electromagnetically replicate the various component configurations found in a typical complex system, such as an aircraft, a missile, a command post blockhouse, a personal computer, or a piece of electronic test equipment.

In the present talk the issue of the influence of the propagation path will be addressed by reporting results from an inchoate study of RF signal propagation through cascaded coupled rectangular cavities. In particular, attention will be devoted to the problem of a transient signal incident upon a narrow slot in an infinite conducting screen that is backed by a rectangular cavity having in its interior a conducting thin-wire probe. The analysis will involve the numerical solution of coupled integral equations in the frequency domain. Transient waveforms of interest will be obtained from the frequency domain results and the known time history of the excitation by means of the FFT. The investigation will consider variations in cavity size and depth, slot length, probe depth and height within the cavity, and the time history of a transient, candidate waveform. The study will involve transient signals whose spectra span a frequency range from nearly DC to 2 or 3 GHz.