Effects of Propagation Path on Transient Signals in Electronic Systems

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The influence of the transmission path on the characteristics of a transient signal as it passes through an electronic system is of importance in discovering how the operation of digital circuits might be altered as a result of unexpected or spurious electromagnetic energy being incident upon, and propagating through, an electronic system. If a signal of a specified form enters a system at a given point, it is desirable to know the salient features of the signal that reaches some location within the system, where a susceptible digital circuit might be located. Moreover, it is useful to know if any of the features of the induced signal are primarily those peculiar to the entering signal, or if they are more influenced by the properties of the transmission path and/or environment. Addressing these issues should help one gain an appreciation for the nature of a spurious signal arriving at the input of a digital circuit embedded deep within a complex system that is subjected to high-power RF excitation originating outside the system proper.

In the present talk the influence of the transmission path (and environment) on the shape and magnitude of a transient signal will be addressed by numerically modeling the propagation of a signal through a variety of structures that contain certain features present in real-world systems. Structures that electromagnetically replicate only the important details of component configurations found in a typical real-world systems are considered. Examples of such systems include aircrafts, missiles, ground vehicles, personal computers, and electronic test equipment.

The structures considered in this talk are metallic rectangular cavities of different sizes with various types of apertures/openings for signal entry, as well as various interior features such as backplanes, wires, cable/trace runs, and discrete components. Signals having various waveforms are used to excite the structures at various entry points. The numerical analysis of the structures is handled both in the frequency domain, via the moment method, and in the time-domain, via the FDTD technique. The talk considers variations in structure and interior features as well as several transient waveforms, whose spectra span a frequency range from nearly DC to 2 or 3 GHz.