

Abstract

Ultra-wideband (UWB) antennas for radar applications require ringing-free short-duration wideband pulses to be transmitted for high-resolution imaging applications. A ringing-free pulse would require not only an appropriate design of the antenna but also its subsequent feed sub-systems. A taper used in the feed which provides impedance matching between the source and the antenna, can however cause undesired ringing in the radiated time-domain far-field. The time-domain analysis will require a proper choice of input pulse in terms of the spectral characteristics. The conventional pulses have restrictions in terms of the required bandwidth for UWB applications. A family of ultra-wideband pulses have therefore been proposed to overcome this limitation. An appropriate way to characterize the ringing has been introduced by the concept of Ringing Rejection Ratio (RRR). The conventional impedance tapers exhibit substantial amount of undesired ringing in the time-domain output. A novel impedance taper has thereby been proposed to overcome the shortcomings of the conventional ones. In measurement a stripline implementation of the proposed taper improves the RRR by an amount of 25 dB in comparison to the conventional ones. The dispersive microstrip implementation of the proposed taper yields a 12 dB improvement in actual measurement compared to the existing tapers. The proposed microstrip taper has been utilized in the feed-system of the UWB antenna which yields 15 dB improvement in RRR in comparison to the conventional feed. Further, an investigation of the undesired ringing in the time-domain output of uniform microstrip based interconnects has been carried out. A non-uniform implementation of the microstrip configuration has been proposed to tackle the dispersive nature of the uniform microstrip line. The proposed non-uniform implementation provides more than 10 dB improvement in RRR in comparison to the uniform one

in measurements. Co-planar stripline and coplanar waveguide implementation of the interconnects have also been modified utilizing the similar philosophy which demonstrates the merit of the proposed technique.

Keywords: Cross-correlation efficiency, double-Y balun, group delay, gaussian pulse, impedance taper, interconnects, non-uniform transmission line, ringing, ringing rejection ratio, ultra- wideband, ultra-wideband antenna.