Study of a Linear UWB Antenna Array

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The design of UWB antennas requires special considerations, for example the control of emission level over the entire UWB bandwidth in all directions and a narrow impulse response in both transmitting and receiving modes, which make the antenna design a challenging process. The single UWB antenna element has been studied extensively. It has been found that UWB antennas should be co-designed with UWB signals in order to obtain a high system performance. When evaluating in the frequency domain, an antenna with good impedance matching, linearly increasing directivity with frequency, and linearly decreasing phase response with frequency over the entire UWB band are required for UWB applications. With the knowledge of the single UWB antenna element, it is the time to study UWB antenna arrays. In this paper, a uniformly spaced linear array comprising planar UWB dipole antennas is studied. First, time-domain waveforms due to the superposition of ten radiating antenna elements are examined. The waveform differs significantly with different relative time delay. Next, the antenna geometry as well as the array configuration are presented. The characteristics of a single antenna element, and the coupling between two adjacent elements are examined with Finite Difference Time Domain (FDTD) method and Method of Moments (MOM). After that, a source pulse is optimized for the UWB antenna array in order to comply with the Federal Communications Commission (FCC)'s regulation. Lastly, the radiation of the array excited by the optimal source pulse is investigated in terms of three different patterns, namely energy pattern, peak value pattern, and cross correlation pattern.