Mutual Coupling Effect on Ultrawideband Linear Antenna Array Performance

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Abstract:

This paper studies the mutual coupling effect between array elements of two- and four-element ultra-wideband (UWB) linear arrays on their performances. For simplicity, it is assumed that both antenna arrays are fed by independent microstrip lines with the same power amplitudes and equal phases. From our study, array bandwidth improvement is achieved for both array types when the mutual coupling is strong enough or inter-element spacing is small. The mutual coupling also enhances the array realized gain especially in the mid-frequency band (5–8.5 GHz) while it deteriorates the gain outside that frequency range. Proper tuning for inter-element spacing with enough mutual coupling enhances the array realized gain at most frequencies and makes it more stable across the desired frequency range. From the radiation pattern results, the grating lobes appear in UWB arrays when the element spacing is greater than two wavelengths at the upper edge frequency, 10.6GHz, or half wavelength at the lower edge frequency 3.1 GHz. Two fabricated array prototypes with corporate feed are fabricated and tested to validate the theoretical analysis. The effect of using T-junction power divider is clear on the reflection coefficient |S11|. Both numerically simulated and experimental results successfully demonstrate our analysis.

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