Guidelines for Student Reports

Sintesi Di Compromise Sum-Difference Patterns Per Time-Modulated Planar Arrays

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Abstract

La tecnica monopulse radar tracking utilizza i pattern somma e differenza per ricavare la posizione angolare di un oggetto: per array planari le eccitazioni sono calcolate utilizzando la sintesi di Taylor per quanto riguarda il fascio somma e utilizzando la sintesi di Bayliss per i fasci differenza. L'utilizzo di due reti di alimentazione separate ed indipendenti è tuttavia una soluzione problematica dal punto di vista dell'occupazione di spazio e della complessità circuitale: per limitare questi inconvenienti è preferibile dunque generare un pattern somma ottimo e considerare invece un pattern differenza approssimato raggruppando tra loro elementi dell'array in sub-array detti aggregazioni. Nel caso specifico gli elementi appartenenti alle stesse aggregazioni sono eccitati mediante medesime sequenze periodiche di impulsi (generate mediante switch RF, ad ogni aggregazione sarà associato un singolo switch), le cui durate rappresentano i parametri su cui agire per sintetizzare il pattern differenza alla frequenza di lavoro: rispetto alle antenne convenzionali infatti, i time-modulated array sfruttano una quarta dimensione, il tempo, nel processo di sintesi. Questo permette di aumentare la flessibilità nel design dell'antenna e di poter riconfigurare il fascio agendo solamente sulla modulazione temporale utilizzata. Tale caratteristica comporta però la generazione di segnali indesiderati a frequenze multiple della frequenza di modulazione che rappresentano uno spreco di potenza (Sideband Radiation o SR).
La tecnica proposta si articola in tre fasi: determinazione mediante CPM (Contiguous Partition Method) delle aggregazioni degli elementi dell'array, e delle sequenze di impulsi da associare ad ogni aggregazione in modo tale che il pattern differenza generato sia il più possibile simile a quello obiettivo ("ottimo"), quindi ottimizzazione delle durate degli impulsi per ridurre lo spreco di potenza mediante algoritmo di ottimizzazione globale Partcile Swarm Optimizer (PSO) e infine ottimizzazione degli shift temporali degli impulsi per ridurre il livello della radiazione alle frequenze armoniche (Sideband Level o SBL) sempre mediante algoritmo PSO.

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