

# Sparse Array Synthesis through BCS with Near Field Constraints

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## Abstract

Applicazioni quali i sistemi per comunicazioni satellitari, per l'imaging biomedicale, per il telerilevamento e la diagnostica elettromagnetica, per il radar e sonar tracking richiedono la realizzazione di array di grandi dimensioni in grado di garantire elevata direttività. L'utilizzo di allineamenti equispaziati in tali applicazioni permetterebbe di raggiungere le prestazioni desiderate, ma con un peso, costo, ingombro e complessità eccessivi. Le tecniche di thinning (assottigliamento) si pongono l'obiettivo di ridurre il numero di elementi radianti in un'antenna ad array, al fine di permettere la realizzazione di array ad elevata direttività con costi e peso ridotti.

In questo ambito, la teoria del Compressive Sampling, recentemente introdotta nell'ambito del signal processing, può rappresentare una metodologia innovativa per la progettazione di sparse arrays. Obiettivo delle tecniche di Compressive Sampling, infatti, è la ricostruzione di segnali incogniti a partire da un numero ridotto di campioni rappresentativi. Una possibile metodologia di progettazione di array lineari che utilizzi tali tecniche si può basare perciò sul seguente approccio:

- scelta del pattern desiderato per l'array (e conseguente scelta dell'eccitazione dell'apertura corrispondente)
- selezione ottimale dei punti di campionamento (spaziale) dell'apertura, mediante Bayesian Compressive Sampling
- calcolo dei coefficienti di eccitazione per ogni punto di campionamento (elemento radiante) mediante Bayesian Compressive Sampling

I vantaggi di tale approccio sarebbero legati alla possibilità di ottenere sottocampionamenti molto significativi dell'apertura (spaziatura molto al di sopra del criterio di Nyquist, cioè  $\lambda/2$ ) pur ottenendo prestazioni estremamente elevate e senza necessità di alcuna ottimizzazione.

Obiettivo dell'attività è perciò investigare l'applicazione delle tecniche di compressive sampling alla realizzazione di array sparsi lineari con prescritte caratteristiche di radiazione in Near Field e con numero minimo di elementi radianti.

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*This report is submitted in partial fulfillment of the degree of the course "DCM".  
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