

# Radiation Patterns and the Quest for Optimal Resolution

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## Abstract

The inverse problem of finding a set of weights given the radiation pattern for a narrowband array is discussed in detail. How the solution depends on the main-lobe width for the radiation pattern is a central theme of the work. Two forms of continuous array – line sources and disc sources – are also discussed.

The singular value decomposition is the main ingredient in the solution of the inverse problem and for this class of problem the singular functions possess concentration and double-orthogonality properties in common with the prolate spheroidal wave functions.

The relationship between superdirective line sources and superdirective linear arrays is explored with the aid of generalised Gaussian quadrature. The same approach is applied to disc sources and the relationship of superdirectivity to apodization in optics is established.

Finally the generalisation of these ideas to broadband line sources and arrays is presented.