Analysis of multicomponent transient signals using MUSIC superresolution technique

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Abstract

The problem of estimating the parameters of transient signals consisting of real decay constants has for long been a subject of study by many researchers. Such signals arise in many problems in Science and Engineering like nuclear magnetic resonance for medical diagnosis, deep-level transient spectroscopy, fluorescence decay analysis, etc. Many techniques have been suggested by researchers to analyse these signals but they often produce mixed results. A new method of analysis using modified MUSIC (multiple signal classification) subspace algorithm is successfully applied to the analysis of this signal. A noisy multiexponential signal is subjected to a preprocessing procedure consisting of Gardenerspsila transformation and inverse filtering. Modified MUSIC algorithm is then applied to the deconvolved data. The parameters of focus in this paper are the number of components and decay constants. It is shown that with this technique parameter estimates do not significantly change with signal to noise ratio. The superiority of this algorithm over conventional MUSIC algorithm is also shown.