Accepted Manuscript

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PII: S0165-1684(17)30422-X
DOI: 10.1016/j.sigpro.2017.12.009
Reference: SIGPRO 6678

To appear in: *Signal Processing*

Received date: 13 August 2017
Revised date: 2 December 2017
Accepted date: 6 December 2017

Please cite this article as: Junli Liang, H.C. So, Jian Li, Alfonso Farina, Deyun Zhou, On Optimizations with Magnitude Constraints on Frequency or Angular Responses, *Signal Processing* (2017), doi: 10.1016/j.sigpro.2017.12.009

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On Optimizations with Magnitude Constraints on Frequency or Angular Responses

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Abstract

We consider optimization problems with nonconvex magnitude constraints on frequency or angular responses encountered in many signal processing problems. To provide a solution to these nonconvex problems, an alternating direction method of multipliers based solution framework is developed in this paper. We apply variable splitting to introduce auxiliary two-element vector variables for each frequency or angular response corresponding to each magnitude constraint. In doing so, this class of problems can be solved in an alternate manner, namely, iteratively tackling two subproblems with respect to the original and introduced parameters. Each new constraint may act on only the corresponding two-element vector variables rather than all of them. The subproblem is also simplified such that it is a function of only one parameter, and we prove the convexity of the resultant single-variable piecewise optimization problem. Finally, the effectiveness of the proposed approach is demonstrated via its successful applications to array pattern synthesis, waveform design and robust beamforming.

Index Terms

Array signal processing, Waveform design, Array pattern synthesis, Beamforming, Filter design.

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