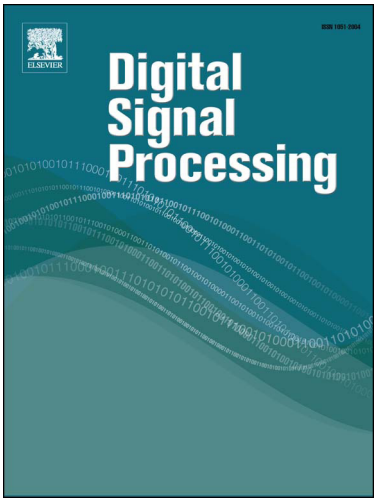
Accepted Manuscript



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PII: S1051-2004(17)30057-X
DOI: http://dx.doi.org/10.1016/j.dsp.2017.03.002
Reference: YDSPR 2095

To appear in: *Digital Signal Processing*

Please cite this article in press as: S. Ouelha et al., An efficient Inverse Short-Time Fourier Transform Algorithm for Improved Signal Reconstruction by Time-frequency Synthesis: Optimality and computational issues, *Digit. Signal Process.* (2017), http://dx.doi.org/10.1016/j.dsp.2017.03.002

An efficient Inverse Short-Time Fourier Transform Algorithm for Improved Signal Reconstruction by Time-frequency Synthesis: optimality and computational issues

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Abstract

This paper presents an improved signal reconstruction method based on a new inverse short-time Fourier transform (ISTFT) estimator. The main challenge addressed in this study is to design a more computationally efficient algorithm called exact formal approach (EFA) which overcomes the drawbacks of the popular overlap and add (OLA) and least squares (LS) methods in several cases of practical interest. The proposed EFA algorithm is based on a vector formulation and the exploitation of properties of the matrix formed by signal samples and frames corresponding to signals segments with overlap. A detailed comparative study shows the advantages of the EFA compared to the OLA and LS methods. Several experiments illustrate the performance and properties of the different estimators. The criteria of comparison are based on synthesis quality and denoising efficiency. The results indicate that, (1) from a computational point of view, the proposed algorithm EFA outperforms other popular ISTFT algorithms including OLA and LS and (2) that the EFA and LS have similar results in terms of synthesis quality and both outperform the algorithm currently most used for ISTFT, the OLA. The proposed EFA estimator can then improve ISTFT based applications involving signal enhancement and denoising.

Keywords:
Inverse short-time Fourier transform, spectrogram synthesis, time-frequency analysis, STFT vector formulation, signal filtering and reconstruction