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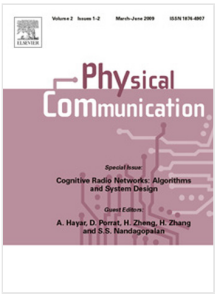

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Lu Liu, Dajun Sun, Youwen Zhang

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A family of Sparse Group Lasso RLS algorithms with adaptive regularization parameters for adaptive decision feedback equalizer in the underwater acoustic communication system

Lu Liu[a,b], Dajun Sun[a,b,*], Youwen Zhang[a,b]

[a] *Acoustic Science and Technology Laboratory, Harbin Engineering University, Harbin 150001, China*

[b] *College of Underwater Acoustic Engineering, Harbin Engineering University, Harbin 150001, China*

Abstract

In this paper, we propose a family of sparse group Lasso (least absolute shrinkage and selection operator) Recursive Least Squares (RLS) algorithms for sparse underwater acoustic channel equalization. The proposed adaptive RLS algorithms employ a family of mixed norms, such as $l_1 l_{2,1}$-norm, $l_1 l_{\infty,1}$-norm, $l_1 l_{2,0}$-norm, $l_1 l_{1,0}$-norm, $l_0 l_{2,1}$-norm, $l_0 l_{\infty,1}$-norm, $l_0 l_{2,0}$-norm, and $l_0 l_{1,0}$-norm, as the sparsity constraint in the penalty function to exploit the sparsity of the underwater acoustic communication system. The proposed adaptive RLS algorithms can adaptively select the regularization parameters regardless of whether the channel of underwater acoustic channel is general sparse channel, group sparse channel or the mixed sparse channel consisting of general sparse channel and group sparse channel. Moreover, this paper presents a direct adaptive decision feedback equalizer (DA-DFE) that exploits any sparse channel structure with the proposed adaptive RLS algorithms in the lake and sea experiments. Experimental results verify that the DA-DFE receiver with the proposed family of sparse group Lasso RLS algorithms can achieve a better performance in terms of convergence rate, mean square deviation (MSD) and symbol error rate (SER) in the single-input single-output (SISO) single carrier underwater acoustic communication system.

*sundajun@hrbeu.edu.cn