第 2 回制御理論ワーキングセミナー

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会場：愛知県名古屋市千種区不老町 名古屋大学工学研究科 2 号館 243 講義室

(キャンパスマップ : http://www.nagoya-u.ac.jp/global-info/access-map/higashiyama/)

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Title：　Hellinger vs Itakura-Saito distance for multivariate spectral estimation

Abstract：

Multidimensional spectral estimation is an old and challenging problem which keeps generatingwidespread interest in the natural and engineering sciences. We present in this talk effective multi-variate generalizations of the THREE - approach introduced by Byrnes, Georgiou and Lindquist in [1, 4]. The latter may be viewed as a (considerable) extension of the Burg-Jaynes Maximum Entropy Method. In the THREE-like estimation methods, the problem is first recast as a generalized moment problem with complexity constraints. Spectral estimation then turns into a constrained spectrum approximation problem where the choice of the (pseudo) distance between spectra is crucial. THREE-like approaches all permit higher resolution in desired frequency bands and are extremely effective in the case of a short observation record. In [3, 5], an approach based on a generalized Hellinger distance motivated by spectral factorization concepts was developed. In our recent paper [2], a multivariate version of the Itakura-Saito distance was employed to solve the state-covariance matching problem. The choice of this Bregman divergence was there motivated by a profound, far reaching connection between relative entropy in the time and spectral domains. The corresponding solution entails a complexity upper bound which improves on the one so far available in the multichannel framework. Indeed, it is equal to the one featured by THREE in the scalar case. The solution is computed via a globally convergent matricial Newton-type algorithm. Simulation suggests the effectiveness of the new technique especially in the case of short data records where it outperforms Matlab's PEM and Matlab's N4SID.

References

[1] C. I. Byrnes, T. Georgiou, and A. Lindquist. A new approach to spectral estimation: A tunable high-resolution spectral estimator. IEEE Trans. Sig. Proc., 49:3189-3205, 2000.

[2] A. Ferrante, C. Masiero, and M. Pavon. Time and spectral domain relative entropy: A new approach to multivariate spectral estimation. IEEE Trans. Aut. Control, to appear. preprint arXiv:1103.5602v1.

[3] A. Ferrante, M. Pavon, and F. Ramponi. Hellinger vs. Kullback-Leibler multivariable spectrum approximation. IEEE Trans. Aut. Control, 53:954-967, 2008.

[4] T. Georgiou. Spectral estimation by selective harmonic amplification. IEEE Trans. Aut. Control, 46:29-42, 2001.

[5] F. Ramponi, A. Ferrante, and M. Pavon. A globally convergent matricial algorithm for multivariate spectral estimation. IEEE Transactions on Automatic Control, 54(10):2376-2388, Oct. 2009.

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