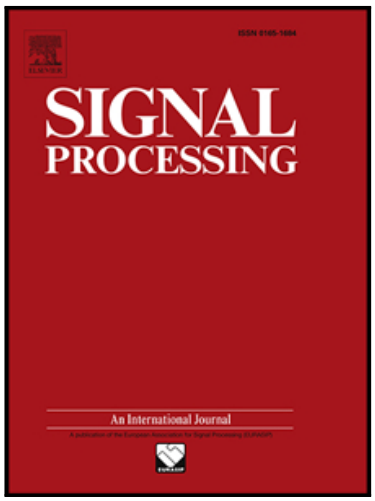

Estimating the order of multiple sinusoids model using exponentially embedded family rule: Large sample consistency

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Estimating the order of multiple sinusoids model using exponentially embedded family rule: Large sample consistency

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Abstract: In this paper, we consider the problem of estimating the number of components of a superimposed multiple sinusoids model. We study the large sample asymptotic properties of the Exponentially Embedded Family (EEF) based methodfor estimation of the order of the multiple sinusoids model. We establish that the estimator of model order using the EEF rule is large sample consistent. Finite sample simulation examples are presented to compare the performance of the EEF rule with three commonly used information criterion based methods.

Keywords: Exponentially embedded family rule, generalized likelihood ratio large sample consistency, likelihood, order estimation, superimposed sinusoidal model.

1.INTRODUCTION

A common problem in the parametric methods of signal processing requires the estimation of integer-valued parameters that typically specify the signal model. Such a detection problem is a fundamental problem in signal processing as the vector of real valued parameters characterizing the signal can then be estimated accordingly. Some examples of such problem include estimation of number of components of sinusoidal signal models in one and higher dimensions, estimation of order for superimposed exponential signals models and multiple chirp signal models and order estimation of ARMA model (see, e.g. [1]-[9] and the references cited therein).

In this paper, we consider the order estimation problem of the following multiple sinusoidal model

$$y_t = \sum_{k=1}^{m} \left(\alpha_k \cos\left(\omega_k t\right) + \beta_k \sin\left(\omega_k t\right) \right) + \varepsilon_t; \quad t = 1, \ldots, n. \tag{1}$$