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SYSTEM IDENTIFICATION AND ERROR ANALYSIS IN FREQUENCY DOMAIN

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Abstract. *The problems of system identification and error analysis based on spectral analysis are considered in frequency domain. A simple algorithm for spectral estimation through discrete Fourier transform is studied and the property of spectral estimation is analyzed by considering the estimation of correlation functions. The proposed approach has low computational complexity and does not require the prior information of model structure so it can be implemented very easily. Furthermore, some approximated evaluations on the estimation errors are presented for spectral estimation and frequency response estimation of the plant model. Numerical simulations show the effectiveness of the proposed identification algorithms and error analysis.*
Keywords: Identification, Spectral analysis, Frequency domain, Correlation function

1. **Introduction.** Mathematical system models are necessary and often play central roles in many practical applications, e.g., control engineering, signal processing, communication system design, etc. However, to build an appropriate system model is usually not an easy work even though the system can be treated as a linear time-invariant one. In some engineering applications, system model can be obtained on the basis of experimentally measured data records through system identification techniques, which can be classified into non-parametric and parametric methods implemented in time domain [1, 2] or frequency domain [3].

Many parametric identification algorithms in time domain have been developed, e.g., least squares method (LS) [4, 5], prediction error method (PEM) [6, 7], maximum likelihood method (ML) [8], instrumental variable method (IV) [9], etc. When applying these parametric identification methods, one has to handle the choice of model structure carefully since it directly influences the accuracy and effectiveness of the identified model [10, 11]. On the other hand, the non-parametric methods such as correlation analysis and