

# SPECTRAL DENSITY ESTIMATION WITH AMPLITUDE MODULATION AND OUTLIER DETECTION\*

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**Abstract.** This paper studies spectral density estimation based on amplitude modulation including missing data as a specific case. A generalized periodogram is introduced and smoothed to give a consistent estimator of the spectral density by running local linear regression smoother. We explore the asymptotic properties of the proposed estimator and its application to time series data with periodic missing. A simple data-driven local bandwidth selection rule is proposed and an algorithm for computing the spectral density estimate is presented. The effectiveness of the proposed method is demonstrated using simulations. The application to outlier detection based on leave-one-out diagnostic is also considered. An illustrative example shows that the proposed diagnostic procedure succeeds in revealing outliers in time series without masking and smearing effects.

*Key words and phrases:* Amplitude modulation, local linear regression, missing observations, outlier detection, spectral density.

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