

Semi-parametric modulation models for variable stars with correlation structure

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Abstract

The Blazhko effect is a periodic amplitude and/or phase modulation shown by some 20-30% of the galactic Lyrae stars. Our goals are modeling and forecasting these light curves. Current approaches implemented by astronomical scientists rely on harmonic models with time-invariant trend and amplitudes and homoscedastic errors. In this paper we introduce a novel approach where we allow for a time-varying trend, time-varying amplitudes, as well as time-varying auto-regressive coefficients of the errors. Our approach is flexible because it does not rely on the unrealistic stationarity assumption and, at the same time, it avoids the caveats of local smoothing. More precisely, we propose a semi-parametric model where only part of the model is time-varying. The estimation of our time-varying curves translates into the estimation of time-invariant parameters that can be performed by ordinary least-squares, with the following two advantages: modeling and forecasting can be implemented in a parametric fashion, and we are able to cope with missing observations. In this talk we illustrate the importance of our method through applications to real data, and evaluate the performance of our estimators via Monte Carlo simulations.