

Frequency estimation of astronomical light curves with red noise

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Abstract

Estimating the periodic behavior of light curves, which are a type of unequally-spaced time series describing a star's brightness over time, is of great interest in Astronomy. In this work we consider a harmonic model with additive red noise. This is a type of correlated noise appearing often in astronomy and it is the equivalent of assuming an AR(1) structure for the residuals of equally-spaced data. We generalize a result from Reimann (1994) and show that our frequency estimate is consistent and asymptotically normal. Furthermore, we consider a type of generalized F-test in order to decide if our estimate is true or the product of noise fluctuations. Finally, we report our simulation results and apply our methods to light curves from the Hunting Outbursting Young Stars citizen science project.

Keywords

Unequally-spaced time series, red noise, power correlation, asymptotics.

References:

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