EPJ Web of Conferences **101**, 06051 (2015)
DOI: 10.1051/epjconf/201510106051

An information preserving method for producing full coverage CoRoT light curves

J. Pascual-Granado[1,a], R. Garrido[1], and J. C. Suárez[1,2]

[1]Instituto de Astrofísica de Andalucía (CSIC), Granada 18008, Spain
[2]Dept. Física Teórica y del Cosmos. Universidad de Granada. 18071 Granada. Spain

Abstract. Invalid flux measurements, caused mainly by the South Atlantic Anomaly crossing of the CoRoT satellite, introduce aliases in the periodogram and wrong amplitudes. It has been demonstrated that replacing such invalid data with a linear interpolation is not harmless. On the other side, using power spectrum estimators for unevenly sampled time series is not only less computationally efficient but it leads to difficulties in the interpretation of the results. Therefore, even when the gaps are rather small and the duty cycle is high enough the use of gap-filling methods is a gain in frequency analysis. However, the method must preserve the information contained in the time series. In this work we give a short description of an information preserving method (MIARMA) and show some results when applying it to CoRoT seismo light curves. The method is implemented as the second step of a pipeline for CoRoT data analysis.

1 Step 1 - Data corrections

The data used in this work have been obtained from the CoRoT archive at the IAS Data Center. After the data are downloaded jump corrections are applied using the Jump Filter algorithm from Jose Manuel Almenara (LAM).

2 Step 2 - Gap filling (MIARMA)

MIARMA [1] is a gap-filling method based on autoregressive moving-average modelling of the data, therefore, it makes no assumptions about the analyticity of the signal. We show that this method remove the aliased periodogram making unnecessary any prewhitening technique. More importantly, the fine-scale structure shown for HD 49933 [2] and the alias shown for HD 51193 cannot be explained by an analytic signal.

3 Step 3 - Test of analyticity

When the function underlying a time series is non-analytic its Fourier expansion is not guaranteed. Therefore, the periodogram can converge to a real value but it is not guaranteed that it is the unbiased estimation of the spectral density. This represents an inconsistency in the harmonic analysis of the time series of pulsating stars. Then, a test for the analyticity of the underlying function of the time series is a necessary step before any consistent Fourier analysis is performed [3].

[a] e-mail: javier@iaa.es

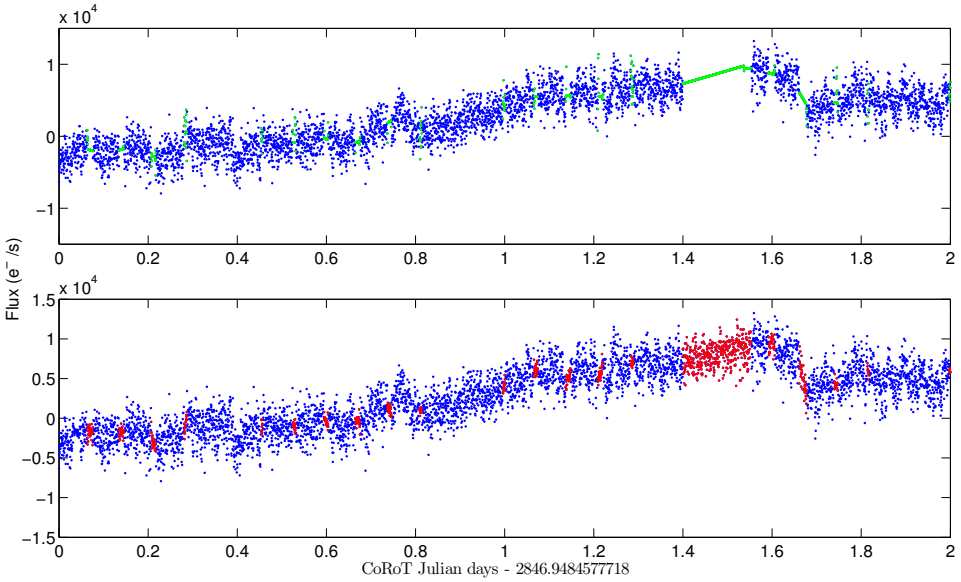

Fig. 1. Comparison of ARMA gap-filling (below) with the corresponding to a polynomial interpolation (above) for the light curve of the solar-like star HD 49933 observed by CoRoT. Notice the fine-structure details in the ARMA interpolation.

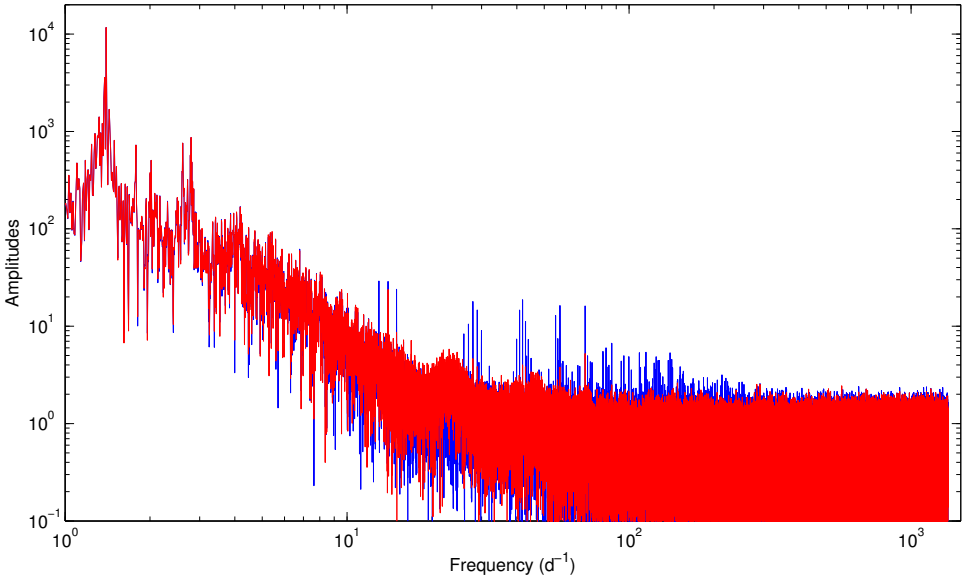

Fig. 2. Comparison of the power spectra for the time series filled using MIARMA (red) with the time series filled using polynomial interpolation (blue). Notice the reduction of the aliases when using algorithm MIARMA.

References

1. Pascual-Granado, J., Garrido, R., Gutiérrez-Soto, J., Martín-Ruiz, S., IAUS **285**, (2012) 392
2. Appourchaux, T., Michel, E., Auvergne, M., et al. A& A **488**, (2008) 705
3. Pascual-Granado, J., Garrido, R., Suárez, J. C. IAUS **301**, (2014) 85