

Multiperiodic and Aperiodic Pulsations: Comparative Study of Algorithms vs. Variability Types

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Abstract. A synopsis of mathematical models describing different types of variability and their application to some classes of stars is given.

A software package has been elaborated allowing complementary methods for time series analysis: multi-periodic, multi-frequency global and local fits with a possible additional trend; fits for signals modulated by a long-term wave; running parabola and running sine fits for the (mono- and multi-) cyclic variations of low coherence and the mode switching stars; determination of the characteristics of the aperiodic “red noise” and deterministic chaos, including the fractal dimension; the least-squares extension of the Morlet-type wavelet analysis with determination of the mean scalegram, time dependence of the best fit parameters, including period and smoothing value; nonparametric periodograms; methods based on the moments of characteristic events only; some other methods. These algorithms are compared according to a statistical significance of the results.

The main applications of these methods to pulsating variable stars in our group (L. L. Chinarova, L. S. Kudashkina, V. I. Marsakova, L. L. Shapovalova) are the following:

- statistical study of the mean characteristics of the trigonometric polynomial fits of the light curves of the Mira-type stars;
- statistical analysis of the correlations between the characteristics (up to 35) of individual cycles of pulsations in the Mira-type stars with a separation of the stars into groups according to presence of some specific correlations; time evolution of these characteristics;
- secondary variations of the symbiotic binary systems with a Mira-type component;
- mode switching in semiregular variables by using the methods of local periodogram analysis; moments of characteristic events; running (multi-) periodic and aperiodic fits; weighted wavelet analysis;
- multiple variability of semiregular stars;
- additional classification of semiregular stars according to the stability of pulsations based on the periodogram analysis with prewhitening.

Some of the papers are available at <http://paco.odessa.ua/~il-a> (mirrored at <http://il-a.webjump.com>).

