LaTeX equations for VStar

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April 18 2020

1 Standard error of the average

$$StdErr = \frac{\sqrt{\frac{\sum_{i=1}^{N}(x_i-\bar{x})^2}{N-1}}}{\sqrt{N}}$$

2 Phase

$$\phi = \frac{t - epoch}{P}$$

3 WWZ

3.1 Time Steps

$$quantize(x) = \begin{cases} 5 \times 10^{\lfloor log_{10}x \rfloor}, & \text{if } \frac{x}{10^{\lfloor log_{10}x \rfloor}} >= 5 \\ 2 \times 10^{\lfloor log_{10}x \rfloor}, & \text{if } \frac{x}{10^{\lfloor log_{10}x \rfloor}} >= 2 \\ 1 \times 10^{\lfloor log_{10}x \rfloor}, & \text{if } \frac{x}{10^{\lfloor log_{10}x \rfloor}} < 2 \end{cases}$$

$$t_{span} = t_n - t_1$$

$$t_{step} = quantize(\frac{t_{span}}{t_{div}})$$

$$tau_1 = t_{step} \times \frac{t_1}{t_{step} + 0.5}$$

$$tau_n = t_{step} \times \frac{t_n}{t_{step} + 0.5}$$

$$tau = [tau_1, tau_1 + t_{step}, tau_1 + 2t_{step}, tau_1 + 3t_{step}, ..., tau_n]$$

where $\lfloor log_{10}x \rfloor$ is the integer part of $log_{10}x$, t_n is the maximum time value (e.g. maximum JD) in the dataset, t_1 is the minimum time value, t_{div} is the number of time divisions specified by the user, t_{step} is the resulting time step, and tau is the set of time values upon which the time-frequency analysis is based. One set of WWZ statistics is computed per frequency per tau value.

4 Polynomial fit

4.1 Equation

$$y = f(t) = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 + ... + \beta_n t^n$$

4.2 Root Mean Square (RMS)

$$RMS = \sqrt{\frac{\sum_{i=1}^{n} (y - \hat{y})^2}{n}}$$

where n is the number of observations, y is the observed magnitude, and $\hat{y}$ is the model predicted magnitude (with y - $\hat{y}$ giving the residual value).

4.3 Akaike Information Criteria (AIC)

$$AIC = \frac{\sum_{i=1}^{n} (y - \hat{y})^2}{n} + 2deg$$

where N is the number of observations, y is the observed magnitude and $\hat{y}$ is the model predicted magnitude (with y - $\hat{y}$ giving the residual value), and *deg* is the polynomial's degree (e.g. 2 if the highest order term is $\beta_2 t^2$).

4.4 Bayesian Information Criteria (BIC)

$$BIC = \frac{\sum_{i=1}^{n} (y - \hat{y})^2}{n} + deg\ ln(n)$$

where n is the number of observations, y is the observed magnitude, $\hat{y}$ is the model predicted magnitude (with y - $\hat{y}$ giving the residual value), and *deg* is the polynomial's degree (e.g. 2 if the highest order term is $\beta_2 t^2$).

5 DCDFT

5.1 standard scan

$$\frac{1}{frequency}$$

$$\frac{1}{4T}$$

$$\frac{N}{4T}$$

5.2 period error

5.2.1 standard error of the frequency

$$s_v = \sqrt{\frac{6s^2}{\pi^2 N A^2 T^2}}$$

where s^2 is the sample variance of the residuals:

$$s^2 = \frac{\sum (X - \bar{X})^2}{N - 1}$$

N is the number of data points, A is the semi-amplitude of the sinusoid for the period in question, and T is the total time span of the data.

5.2.2 standard error of the semi-amplitude

$$s_A = \sqrt{\frac{2s^2}{N}}$$

where A is the semi-amplitude of the sinusoid for the period in question, s^2 is the sample variance of the residuals, N is the number of data points.