Pulsar timing analysis in the presence of correlated noise

W. Coles, G. Hobbs, D. J. Champion, R. N. Manchester, J. P. W. Verbiest

(Submitted on 27 Jul 2011)

Pulsar timing observations are usually analysed with least-square-fitting procedures under the assumption that the timing residuals are uncorrelated (statistically "white"). Pulsar observers are well aware that this assumption often breaks down and causes severe errors in estimating the parameters of the timing model and their uncertainties. Ad hoc methods for minimizing these errors have been developed, but we show that they are far from optimal. Compensation for temporal correlation can be done optimally if the covariance matrix of the residuals is known using a linear transformation that whitens both the residuals and the timing model. We adopt a transformation based on the Cholesky decomposition of the covariance matrix, but the transformation is not unique. We show how to estimate the covariance matrix with sufficient accuracy to optimize the pulsar timing analysis. We also show how to apply this procedure to estimate the spectrum of any time series with a steep red power-law spectrum, including those with irregular sampling and variable error bars, which are otherwise very difficult to analyse.

Comments:	Accepted by MNRAS
Subjects:	**Instrumentation and Methods for Astrophysics (astro-ph.IM)**
Cite as:	**arXiv:1107.5366 [astro-ph.IM]**
	(or **arXiv:1107.5366v1 [astro-ph.IM]** for this version)

Submission history

From: George Hobbs [view email]
[v1] Wed, 27 Jul 2011 01:39:47 GMT (732kb)

Which authors of this paper are endorsers?