

The correlation structure of time series is of fundamental importance in diagnostic procedures. The squared autocorrelation function of the residuals of a fitted model is generally used as a measure of the goodness-of-fit; multivariate analogues are available for vector time series. As an alternative, we propose a logarithmic transformation of the determinant of a constructed Toeplitz matrix containing the typical measure of correlation. Theoretical results demonstrate the proposed measure is asymptotically more powerful than the typical measure of correlation (when used with or without the Ljung–Box correction) in the detection of a variety of residual dependence structures. The proposed method is shown to have utility when applied in conjunction to a host of methods used to diagnose the fit of strong and weak autoregressive moving average models and generalized autoregressive conditional heteroskedastic models. A simulation study demonstrates the effectiveness of the proposed method and illustrates its improvement over the existent procedures.