On the Sphericity Test with Large-dimensional Observations

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In this paper, we propose corrections to the likelihood ratio test and John’s test for sphericity in large-dimensions. New formulas for the limiting parameters in the CLT for linear spectral statistics of sample covariance matrices with general fourth moments are first established. Using these formulas, we derive the asymptotic distribution of the two proposed test statistics under the null. These asymptotics are valid for general population, i.e. not necessarily Gaussian, provided a finite fourth-moment. Extensive Monte-Carlo experiments are conducted to assess the quality of these tests with a comparison to several existing methods from the literature. Moreover, we also obtain their asymptotic power functions under the alternative of a spiked population model as a specific alternative.