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On some tests of the covariance matrix under general conditions

Abstract We consider the problem of testing the hypothesis about the covariance matrix of random vectors under the assumptions that the underlying distributions are nonnormal and the sample size is moderate. The asymptotic expansions of the null distributions are obtained up to $n^{-1/2}$. It is found that in most cases the null statistics are distributed as a mixture of independent chi-square random variables with degree of freedom one (up to $n^{-1/2}$) and the coefficients of the mixtures are functions of the fourth cumulants of the original random variables. We also provide a general method to approximate such distributions based on a normalization transformation.