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EMPIRICAL CHARACTERISTIC FUNCTION APPROACH TO GOODNESS-OF-FIT TESTS FOR THE CAUCHY DISTRIBUTION WITH PARAMETERS ESTIMATED BY MLE OR EISE

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Abstract. We consider goodness-of-fit tests of the Cauchy distribution based on weighted integrals of the squared distance between the empirical characteristic function of the standardized data and the characteristic function of the standard Cauchy distribution. For standardization of data Gürtler and Henze (2000, *Annals of the Institute of Statistical Mathematics*, **52**, 267–286) used the median and the interquartile range. In this paper we use the maximum likelihood estimator (MLE) and an equivariant integrated squared error estimator (EISE), which minimizes the weighted integral. We derive an explicit form of the asymptotic covariance function of the characteristic function process with parameters estimated by the MLE or the EISE. The eigenvalues of the covariance function are numerically evaluated and the asymptotic distributions of the test statistics are obtained by the residue theorem. A simulation study shows that the proposed tests compare well to tests proposed by Gürtler and Henze and more traditional tests based on the empirical distribution function.

Key words and phrases: Asymptotic distributions, Fredholm determinant, integrated squared error estimator, integral equations, maximum likelihood estimator, residue theorem.