Anderson–Darling statistic and its “inverse”

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For more than 60 years, Anderson-Darling statistic is one of the most popular in applications among the Cramér-von-Mises goodness-of-fit tests. This statistic modifies the classical empirical process in the interval [0, 1] by multiplying it by a weighting function $e^{-(t-0)^2}$. The weighting function redistributes the test sensitivity to deviations of the alternative distribution function from the hypothetical on different subsets of [0,1]. In practice, the tests can be of interest having other weight functions. The paper proposes new formulas for eigen functions of the Anderson-Darling statistics. Also, it was analyzed as statistic “inverse” to the Anderson-Darling statistic with the weighting function $e^{-(t-0)^2}$. This was considered also as another weighting function. The proposed theory is based on the use of various special functions. In practice, it could be useful for the Cramér-von-Mises tests with weighting functions from the family $e^{-(t-0)^2}$, $\alpha>-1$, $\beta>-1$. The paper contains a table of distribution for these statistics with different values of the degrees $\alpha>1$ and $\beta>-1$. The table was calculated by different methods with good precision without using the statistical simulation.

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