ERRORS OF PARAMETERS IN A LEAST SQUARE FITTING PROCEDURE

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It is explicitly shown that errors of parameters based on the least square sum of a least square fitting procedure, that are commonly used in low-energy nuclear physics and especially in its applications (ref. 1, for instance), cannot serve as a reliable measure of the departure of a function resulting from the fitting procedure through the single set of measurements of the function from the "true" functional dependence which is being measured. Since the rigorous application of the maximum likelihood method (refs.2,3) is rather intricate and since the majority of physicists is not well acquainted with it we suggest that the intuitively clear Monte-Carlo approach should be used whenever possible. Besides, it will always explicitly reveal the difficulties inherent to the measurement of each particular functional dependence. The procedure will run as follows.

The function is measured in n points and the function that fits the points is found by the common least square method. The values of this function in the same n points are N times dispersed (programme is described in ref.4) in accordance with the appropriate statistical distribution (other factors than pure statistics can be included). Through each set of n dispersed points (generated "experiments") the new least square function is fitted. N values for each parameter emerge as a result. They form the particular distribution for each parameter. Mean value of each distribution coincides (the better both n and N are greater) with the value of the parameter belonging to the function fitted through the real experimental points. This value of a parameter is taken as its final experimental value. Half width of the distribution of a particular parameter at a half maximum is taken as its error. The "real" value of a parameter, that would result as a mean from an infinite number of measurements of a function, then lies within this interval with the probability close to 0.68 .

References:

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