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Lewis Research Center

Computer Program for Fitting Low-Order Polynomial Splines by the Method of Least Squares

FITLOS is a computer program which implements a new curve-fitting technique. This technique consists of (1) dividing the set of data points into subsets, (2) fitting a polynomial of degree two or three to each subset, and (3) smoothing the total curve by assuring that the first derivatives in the case of second degree polynomials, or the first and second derivatives in the case of third degree polynomials, are equal at the break points of each segment of the curve. These continuity constraints are imposed by use of Lagrangian multipliers.

This method can be useful in cases where (1) the data contains random errors such that the application of any known methods of interpolation would lead to undesirable errors, (2) the use of polynomials of sufficiently high degree, to provide formally small errors, would result in computational difficulty because of the occurrence of large coefficients of opposite signs, and (3) a reasonable initial value guess is desired for some iterative computational or research process.

The main program, FILTOS, reads the input data, calls the appropriate subroutines for the curve-fitting, calculates a statistical analysis, and writes the output data. The modular structure of this program allows a potential user to incorporate this procedure into another computer program since the curve-fitting requires only three subroutines: one to divide the data into subsets, one to define the matrices in the weighted residual equation, and one to solve the equation.

There are four methods provided for dividing the data into subsets. The user determines which method is to be used by a proper setting of the input variables. The user has the option of selecting the spline joints, of selecting the number of segments, of force fitting, or of choosing one of the methods the program is designed to do automatically.

This method was devised as a result of a need to suppress the noise in the calibration of multiplier phototube capacitors, where the independent variable was time and the dependent variable was digitizer counts. One example of this application is given as a sample problem along with another example of the application of this method to the approximation of an analytic function in order to obtain further information about it, i.e., the derivative and the definite integral.

Notes:

1. This program is written in FORTRAN IV, Version 13/ALTIO for use on an IBM-7094/7044 DCS computer.
2. Inquiries concerning this program should be directed to:

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