AEC-NASA TECH BRIEF

Method Reduces Computer Time for Smoothing Functions and Derivatives Through Ninth Order Polynomials

An efficient technique to compute polynomial smoothing functions and/or derivative calculations of cubic polynomials is fully described in *On Smoothing Functions*, by Conrad A. Wilgus and Dr. Robert D. Glauz, Report No. Nuclear Division RN-DR-0146, January 1968, NERVA Program, Aerojet-General Corporation, Sacramento, California.

In collecting masses of data from an observation a mathematical function is needed to best represent the data. One function commonly used is any orthogonal polynomial of the form

$$Y(u) = a_1P_1(u) + a_2P_2(u) + a_3P_3(u) + \ldots\ldots$$

where

$$P_1(u) = u$$

$$P_2(u) = u^2 - \frac{1}{12}(N^2 - 1)$$

$$P_{i+1}(u) = P_1P_i - \frac{i\,(N^2 - i^2)}{4(4i^2 - 1)}\,P_{i-1}$$

with N = number of observations in the data set.

It is necessary to determine the constants (a_1, a_2, a_3 . . .) and the errors involved in estimating these constants. Generally, a least squares analysis is used to determine these constants. This method, however, usually requires a huge computer storage capacity. The report describes an efficient technique to compute these constants and their derivatives and thus determine the orthopolynomial with much reduced computer time.

The analysis in the report presents an efficient technique to adjust previously calculated orthogonal polynomial coefficients for an odd number of equally spaced data points. The polynomial data span is advanced along the abscissa by the deletion and addition of one data point; this information is employed to adjust the polynomial coefficients. The adjusting technique derivation is presented for a ninth order polynomial; whereas the error analysis and the discussion of application to smoothing and derivative calculation are presented for a cubic polynomial.

Note:

Copies of the report are available from:
Technology Utilization Officer
AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
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Patent status:

No patent action is contemplated by AEC or NASA.

Source: C. A. Wilgus and R. D. Glauz of the Aerojet-General Corporation under contract to AEC-NASA Space Nuclear Propulsion Office (NUC-10334)

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