AEC-NASA TECH BRIEF

Root-Cubing and General Root-Powering Methods for Finding the Zeros of Polynomials

A generalized mathematical-analysis technique is reported (*1*) that generalizes a root-squaring and root-cubing method into a general root-powering method. The introduction of partitioned polynomials into this general root-powering method simplifies the coding of the polynomial transformations into input data suitable for processing by computer. The method is extended to include analytic functions.

The root-squaring method, in conjunction with the resultant procedures, has proven reliable and very fast in practical applications. However, for determination of whether the real roots of a polynomial are positive or negative, a test routine is required that is extraneous to the elegance of the resultant procedures. Testing the sign or real roots probably can be always eliminated when the root-squaring process is replaced by a root-cubing process.

The general root-powering process, using partitioned polynomials, was developed for pure mathematical curiosity; because of the harmonious result, soon it may well become a practical method. Also, the algorithms presented in the latter sections (*1*) may develop practical value.

First are presented (*1*) the root-cubing and root-squaring methods and a comparison of the two; later the general root-powering method is illustrated. Firstly a simple method is presented for transforming a given polynomial into one of the same degree whose roots are the pth powers of the original roots. The method is based on the theory of symmetric polynomials and is a generalization of the root-squaring method from $p = 2$ to arbitrary p. Then it is shown that such transformations can always be accomplished over a ring of partitioned polynomials.

Reference:

1. E. H. Bareiss, *ANL-7344* (Argonne National Laboratory, June 1967).

Notes:

1. This information may be useful in functions apportionment and control applications for systems, and in materials and stress-analysis engineering; it may interest designers or manufacturers of large-scale automatic control systems.
2. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
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   Reference: B69-10424

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Patent status:

Inquiries concerning rights for commercial use of this innovation may be made to:

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