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NASA TECH BRIEF

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A Power-Spectral-Density Computer Program

The problem:

When an engineer receives a random-noise test specification in the form of a PSD (Power-Spectral-Density) sketch on log–log coordinates, he may spend several hours or days on slide rule calculations to verify and interpret the data. A faster method for verification and interpretation was needed. A general computer program was required that would: (1) be easy to use; (2) give accurate results for any random-noise test specification without requiring modification other than changing data cards; (3) have an easy-to-read output; and (4) be self-explanatory.

The solution:

A computer program in which random-noise vibration test results can be simplified and made more meaningful for the test requester. The program can also be used to verify PSD test specifications, and set up automatic equalization equipment. An exact acceleration level for the shaped random noise can be calculated prior to the test.

How it's done:

Spectra ratios appear to simplify the interpretation of the test results; however, to synthesize a meaningful spectra ratio, it is necessary to have the exact acceleration densities of the ideal PSD spectrum for the vibration test at small frequency increments across the PSD spectrum. Spectra ratios are obtained when the ideal g^2/cps is ratioed against the vibration test g^2/cps. The results can be expressed in decibels as: $10 \log_{10} \times$ratio.

The program is written in three segments. The first segment, labeled $IBFTC MAIN, reads the data cards into the computer and prints out the results of the calculations. The calculations for acceleration density are performed in the second segment, labeled $IBFTC SUBPSD. This segment is a subprogram called SUBROUTINE PWR.

The third segment, labeled $IBFTC RMS, calculates the area under each slope (g^2_{rms}), then sums each area and takes the square root of the sum to obtain the total acceleration G_{rms} TOTAL. This is performed in a subprogram called SUBROUTINE GRMS.

To use the program, it is only necessary to understand what the variables are and how to represent them by numbers on card or code form sheet. There is one data card for each slope of the PSD specification, including zero slopes.

Notes:

1. Machine requirements are an IBM 7090/94 computer system.
2. Fortran IV was the programming language used.
3. Inquiries concerning this innovation may be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10160

Patent status:

No patent action is contemplated by NASA.

Source: C. P. Chapman
Jet Propulsion Laboratory
(NPO-10126)

Category 01

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