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NASA TECH BRIEF

Marshall Space Flight Center

Response Of A Panel Structure To Reverberant Acoustic Excitation

The problem:

A study was made of aerodynamic excitation and proposed space shuttle configurations and re-entry trajectories. The study revealed that attached turbulent boundary layer, separated turbulent boundary layer, and base pressure fluctuations are the regions of aerodynamic excitation most applicable to exterior panels of space shuttle-type vehicles. Prediction techniques were needed for these three aerodynamic environments.

The solution:

An investigation was made of methods for predicting the response of panel structures to acoustic excitation. A computer program was then generated to calculate the response of the panel to a reverberant acoustic field, using a normal mode approach developed for low frequency response.

How it's done:

The program uses as input the output tape from the Structural Network Analysis Program (SNAP-Dynamics available as MFS-21531 from COSMIC) along with data cards. The SNAP output tape provides the natural frequencies and mode shapes, normalized to unit generalized mass, of a panel structure to be exposed to a reverberant acoustic field. The data cards provide the power spectral density of the acoustic field, damping values of the panel modes, designation of the panel modes to be used in the analysis, designation of the joints in the finite element model to be used in the double area integration over the mode shapes, and designation of the joint where the response is to be determined.

The primary output of the program is four SC-4020 plots, giving the power spectral densities of the response displacement and acceleration using both linear and log-log scales.

Although the program was written for a reverberant acoustic field, it can be easily modified to handle other types of acoustic fields by changing the spatial correlation calculation. However, the program is designed strictly for panel-type response and only determines response perpendicular to the plane of the panel.

Notes:

1. This program was written in FORTRAN V for use on the UNIVAC-1108.
2. Inquiries concerning this program should be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: MFS-21774

Source: Dennis Cadin, Jr. of
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