NASA TECH BRIEF
Marshall Space Flight Center

Vibrational Transfer Functions For Complex Structures

The problem:

The accuracy of structurally mounted instrumentation and experiments with precise pointing requirements is greatly dependent on the operational vibration levels. This vibration environment is due to the structural response to various forcing functions applied during the operation of the equipment experiments.

The solution:

By developing vibrational transfer functions between equipment support areas and points of applications of the forcing functions, the effects of the vibrational multiple frequency forcing functions may be evaluated. A general computer program has been developed for this purpose.

How it's done:

The generated transfer functions can be used to determine structural response due to a variety of forcing functions. These are (1) single frequency, (2) multiple frequency, (3) random, and (4) complex periodic. The program has the capability of analyzing any complex structure composed of up to 50 substructures with a maximum of 162 degrees of freedom in each substructure. There is also capability of providing plots of the transfer functions which can easily be used to determine vibrational response to any given forcing function in the above categories.

The basic input to the program is the coupled structure modal properties. It should be noted that for use of the response transfer function program, basic structural analysis programs such as finite element and modal analysis programs must be available.

Possible applications of this program are:

1. determination of instrumentation and experiment motion due to equipment generated forcing functions for aerospace structures, such as payloads in orbit;

2. determination of the response of land vehicle to operational forcing functions, such as rough roads represented by steady state or random inputs; and

3. determination of the structural response of equipment support structure to excitation generated by stationary machinery.

Notes:

1. This program is written in FORTRAN IV for use on the CDC-6500 computer. It has plotting capability on the CDC-280 plotter.

2. Inquiries concerning this program should be directed to:

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