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NASA TECH BRIEF

Electronic Analog Equalization for Vibrational Testing

The problem:

Structural qualification of a spacecraft requires that it be designed and constructed with sufficient strength to withstand dynamic forces while actually in powered flight to perform its mission, but because of the extremely high factor of thrust energy requirement to payload put into flight, the spacecraft must be designed with a minimum of unnecessary weight. Therefore, the more realistically the effects of such forces on the spacecraft can be simulated during qualification testing, the more adequately its structure can be designed. When such simulations are only approximate, prudence dictates that large safety factors be used. When they approach what can realistically be expected, the safety factor can be reduced and considerable savings in weight and thrust energy requirements can be realized. However, simulation of some of these forces has not heretofore been exact enough to permit use of lower safety factors.

The solution:

A technique that relates to multiple shaker environmental vibrational testing of spacecraft. A novel method of real time equalization involving use of a specially devised analog computer achieves more effective qualification testing by realistically simulating the effects of the vibrational forces which will actually be experienced in powered flight. The analog computer is programmed to simulate the equations of motion of the electromechanical system made up of the spacecraft and the multiple shakers. The input to the computer is an electrical signal representing the acceleration time histories which it is desired to reproduce for the vibration testing of the spacecraft. The output of the computer drives separate power amplifier-shaker mechanisms which apply distinctive driving forces at different locations of the spacecraft. The forces produce responses which correspond to the desired acceleration time histories.

Note:

Requests for further information may be directed to:

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Reference: TSP69-10472

Patent status:

No patent action is contemplated by NASA.

Source: Marc R. P. Trubert of
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