innovations

from The University of Vermont

TITLE: ACTIVE VIBRATION DAMPING FOR CIRCUIT BOARDS

INVENTOR: Dryver Huston, Brian Esser, James Plumpton

DESCRIPTION: This invention is a method for actively damping the vibrations of electronic circuit boards (ECBs). ECB's that are used in spacecraft, aircraft and missile systems are exposed to severe shock and vibrations. Vibration frequencies seen in such applications can range from 3 to 5000 Hz, with acceleration levels from 1G to 30G's (#1, pg11). The volume and weight of these electrical systems is crucial to their design. Electrical boxes, housing many ECB's are often strangely shaped to fit in small available spaces. The weight of any component used on spacecraft and aircraft are critical to fuel consumption and cost. Traditionally, ECB's that are exposed to such environments are designed to be very robust to prevent failure. Bulky mounting fixtures and reinforcing ribs are often used to reduce deflection and stresses in the boards due to vibration. Entire electronic subassemblies containing many ECB's may also be mounted with vibration isolators. The problem with these reinforced ECB's and vibration isolators for large boxes is that they consume too much space and add considerable weight to electrical systems. Active damping systems offer the opportunity to considerably reduce ECB vibrations by using active mechanical devices to damp the vibrations. There is a potential for a large reduction in weight relative to the use of passive systems.

The operating principle of an active mass damper is that it counteracts the vibrations of an object by driving a small mass in a motion that is out of phase with the vibrations of the object. The inertia forces generated by the active mass quell the vibrations. The main components of the system are shown in Figure 1. These are: 1. Active mass – This is a mass that is attached to the vibrating structure. The mass of the active mass usually ranges from 1 to 10% that of the vibrating structure. 2. Actuator – This is an electromechanical device that drives the active mass out of phase with the vibrations. The actuator will most likely be either a voice coil electromagnetic device, or a piezoelectric device. 3. Transducer – This will sense the vibrations of the structure. It will most likely be a MEMs-based accelerometer. 4. Signal Processor – The vibrations measured by the transducer will be processed to produce a control signal for the actuator and the inertial mass. The signal processor can be a simple operational amplifier or microprocessor. 5. Power amplifier – The control signals from the signal processor will be amplified to power the actuator and to drive the inertial mass.

The use of an active damper can result in overall structural weight reductions of 10 to 30%.

ADVANTAGES: This appears to be the first application of active vibration damping to the problem of excessive vibrations in circuit boards. A variety of passive techniques are already used to dampen excessive vibrations. The use of active damping offers the opportunity to reduce vibrations with devices that weigh less than the passive systems. Weight reduction can be very valuable in certain applications, such as aerospace electronics

PATENT STATUS: Provisional Patent

LICENSING STATUS: World wide rights available

CONTACT: Todd S. Keiller, Director, Technology Transfer University of Vermont

1 Pendulum Pass
Hopkinton, MA 01748

tel (508) 497-2497
fax (508) 497-0733
email: kinaird@aol.com