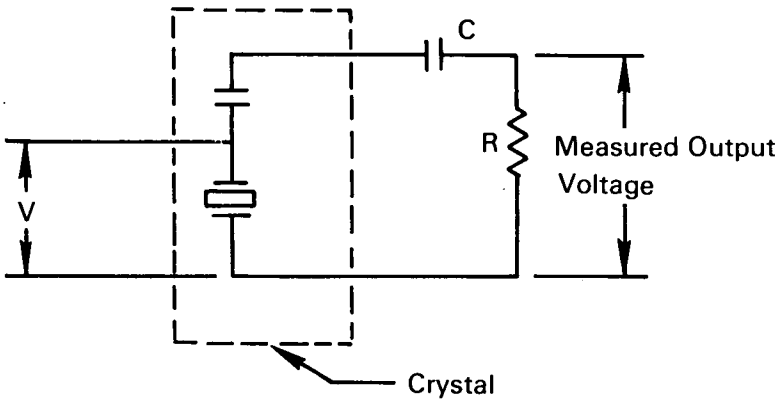
NASA TECH BRIEF

Crystal Measures Short-Term, Large-Magnitude Forces



The problem: To measure transient accelerations and their rate of change associated with high frequency vibrations and shock.

The solution: A device that uses the characteristic response of a piezoelectric crystal to distortion and compression. Output of the crystal is fed to an integrating circuit that measures its magnitude, which is proportional to the physical force acting on the crystal.

How it's done: When a force is applied to a piezoelectric crystal, a charge proportional to the force is driven off the crystal. The device measures the rate of change of force applied by acceleration by measuring the rate of change of the electrical charge. The device consists of a crystal and an integrating circuit made up of an arbitrary capacitance C and an arbitrary resistance R. The voltage output of the crystal is applied to the integrating circuit. The resulting voltage across the resistance R is proportional to the rate of change of acceleration. This design achieves a time constant large enough for adequate sensitivity yet small enough to accommodate conventional ranges of frequency input.

Notes:

1. This would be a useful device to supplement an accelerometer and take over its function when its range was exceeded.
2. The device could be used in a servo control system that is subject to derivatives higher than acceleration.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B65-10187

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Carl G. Pfeiffer (JPL-77)

Category No. 01