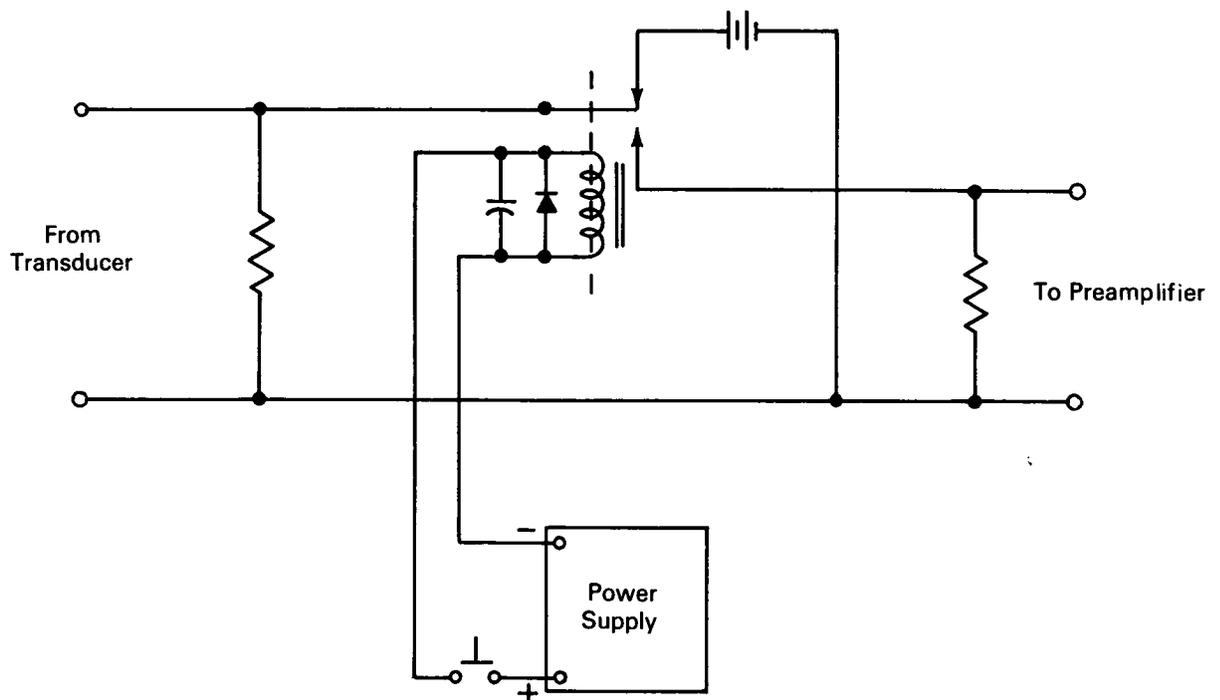


NASA TECH BRIEF



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Method Permits Mechanical and Electrical Checkout of Piezoelectric Transducers While Installed in a System



The problem:

To devise a simple and reliable method to permit checkout of the mechanical and electrical condition of piezoelectric transducers of the cantilever beam type, while installed in a system. In this type of transducer, the sensing element serves also as the spring. Prior methods involved the simulation of the transducer output by inserting a voltage into the system which could be used to evaluate the condition

of the electronics, but did not permit an evaluation of the mechanical condition.

The solution:

Apply a known dc voltage to the piezoelectric element and then remove the voltage suddenly. This causes the beam to vibrate at its natural frequency and decay in accordance with whatever damping is present. The sensitivity is related to the maximum

(continued overleaf)

deflection of the element, and the mechanical condition of the element is indicated by the natural frequency and character of the waveform.

How it's done:

A known dc voltage is applied to charge the piezoelectric element which will deflect by an amount directly proportional to the applied voltage. The charge is then removed by energizing a relay. This energy is dissipated through a resistor, and the potential energy induced by deflecting the element is dissipated by the damping of the spring mass system. These two dissipations of energy occur concurrently, with the surge charge dissipating first. The element then continues to vibrate at its natural frequency at a decay rate depending upon the amount of damping. The sensitivity is related to the maximum deflection, and the mechanical condition is indicated by the natural frequency and character of the waveform. Any change from the original condition such as a

change in end fixity, cracks in the element, or mass loss can be readily detected. A diagram of the test circuit is shown.

Notes:

1. A cantilever beam type piezoelectric transducer is described in Tech Brief B66-10534, "Miniature Piezoelectric Triaxial Accelerometer Measures Cranial Accelerations," November 1966.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B66-10533

Patent status:

No patent action is contemplated by NASA.

Source: V. L. Rogallo and R. S. Jenkins
(ARC-73)