View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

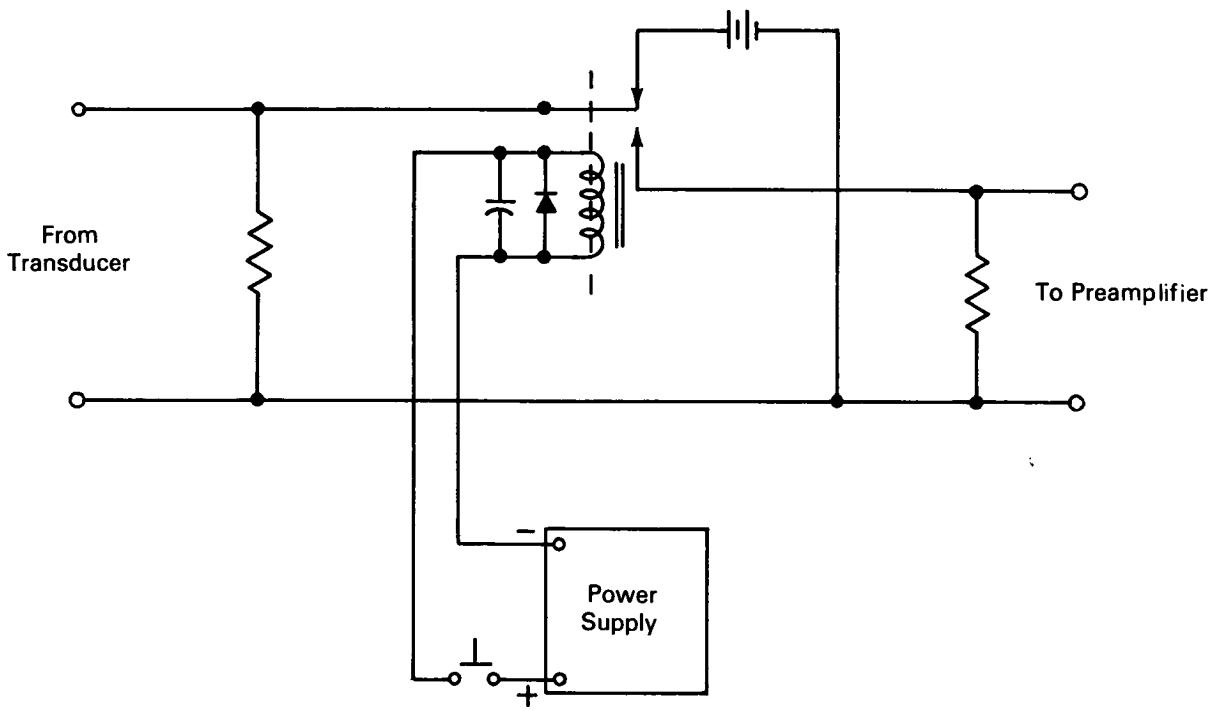
provided by NASA Technical Reports Server

November 1966 Brief 66-10533

NASA TECH BRIEF

NASA Tech Briefs are issued to summarize specific innovations derived from the U. S. space program and to encourage their commercial application. Copies are available to the public from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

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)

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.

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)