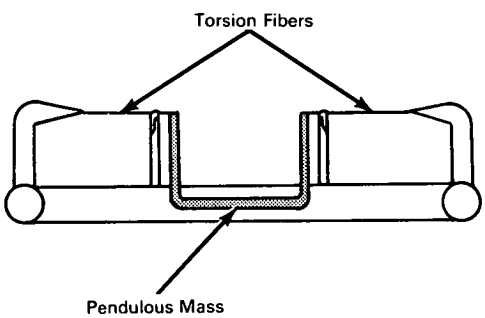
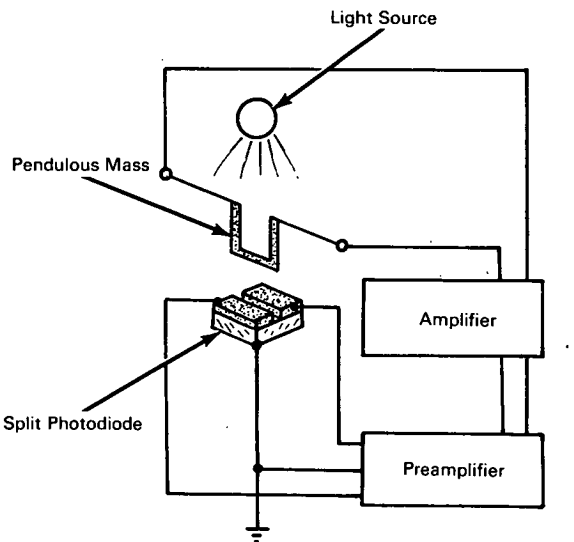
NASA TECH BRIEF

Miniature Servo Accelerometer Is Force-Balanced





The problem: To design an accelerometer that is small, rugged, and simple in construction and that incorporates sensitivity and accuracy comparable to the output of more bulky, complicated, and sophisticated instruments.

The solution: A miniature servo accelerometer whose pendulous mass is suspended by fused quartz torsion fibers in an electromagnetically force-balanced environment.

How it's done: The "U" shaped pendulous mass is suspended by fused quartz fibers connected to each arm of the U. The fibers restrict all movement of the pendulous mass (except a torsional response to an applied acceleration). The pendulous mass, with its suspension system, is coated with a thin layer of gold to make it electrically conductive. Two permanent magnets are placed (with like poles facing) on either side of the pendulous mass, setting up a uniform magnetic field around the pendulous mass in its normal center position as suspended by the torsion fibers. A light source is mounted above the pendulous mass and a split photosensitive diode is mounted beneath the mass and between two shutters that direct the light to both sensitive faces of the split diode about the pendulous mass. With the instrument at rest, an equal amount of light falls on each face of the diode and their output currents cancel. When an accelerative force causes the pendulous mass to move from its center position along its sensitive axis, more light falls on one face of the photodiode than on the other. As a result, feedback current is applied to the electrically conductive pendulous mass in the appropriate polarity, thus producing a restoring force on the mass and bringing it back to its center position.

(continued overleaf)

Notes:

1. This would be useful in gravity surveys for exploring mineral deposits, particularly oil.
2. The invention could be used as a surface attitude servo device to register surface changes in attitude with respect to the vertical, and to feed an output to a corrective electromechanism.
3. The technique lends itself particularly to measurement of unusually small forces or torques.

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