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NASA TECH BRIEF

Lyndon B. Johnson Space Center

Solid-State Controller

The problem:

Attitude controllers, used to guide the roll, pitch, and yaw of a vehicle in flight, are complex. Although simple in external appearance, these controllers enclose a multitude of switches, gears, cams, and other hardware needed to transmit the pilot's commands to the attitude control systems. With their many moving parts, such controllers require frequent servicing to maintain high reliability.

The solution:

A new attitude controller design, using magnetic coupled transducers, eliminates many mechanical parts, improving reliability and reducing maintenance.

How it's done:

The heart of the new design is a transducer which includes three Hall-effect generators, for redundancy, and a magnet, as shown in Figure 1. The transducer contains a magnetized rotor having six pole-pieces There are three Hall-effect generators spaced evenly

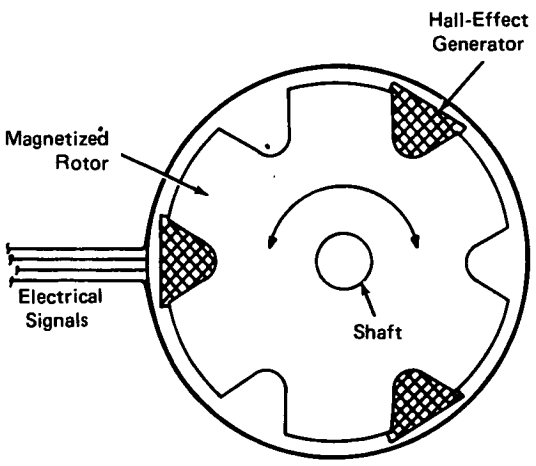

Figure 1. Transducer Element

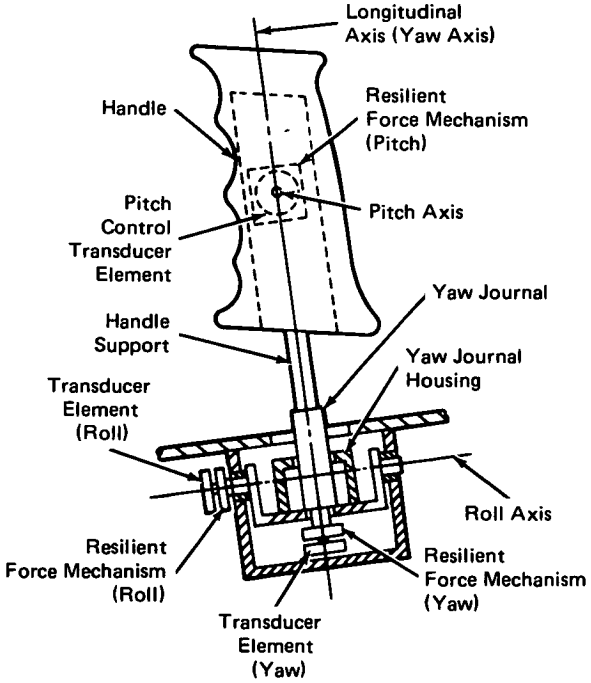

Figure 2. Three Axis Controller

about the rotor. As the pole pieces are rotated to the desired attitude position, the Hall-effect generators react to the position of the rotor and transmit an electrical signal to the proper attitude control system. Each of the three generators is sufficient to provide a control signal; however, three are used for system redundancy. Because there is no physical contact between the magnet rotor and the Hall-effect generators, wear in the transducer is minimized.

The attitude controller (Figure 2) includes three such transducers, allowing independent controls for yaw, pitch, and roll axes. Each axis is directly coupled, eliminating the requirements for gears or levers. Pitch control is incorporated in the handle which may be rotated about the pitch axis perpendicular to the

(continued overleaf)

longitudinal (yaw) axis of the controller. Yaw and roll controls, on the other hand, are governed by the movement of the handle support. Each control includes a resilient force mechanism which returns the control to the neutral-attitude position. The rotation of any control rotates the corresponding transducer. The transducer then generates proper electrical signals to operate the corresponding attitude control system.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Johnson Space Center
Code AT3
Houston, Texas 77058
Reference: TSP73-10466

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,771,037). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
Johnson Space Center
Code AM
Houston, Texas 77058

Source: C. L. Bailey
Johnson Space Center
(MSC-12394)