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Gimbal Angle Sensor

Sensors for detecting the angular movement of rotation elements are usually very long (if detection is linear) or expensively shaped (if detection is to be angular). In the development of a gimbaled reaction wheel mounting, limitations on space and weight precluded using state-of-the-art methods for sensing gimbal rotation. Instead, a mechanical differentiator is slotted so that the first derivative of the radius vector with respect to the rotation angle is a constant. Thus, as light passing through the slot strikes the detector, the relative position of the spot on the surface of the detector is a direct measure of angular displacement.

The system incorporates a standard light source and a commercially available photoresistive element. Rather than using optical collimation, the innovator designed a rectangular light channel that is lighter and more effective. The mechanical differentiator is a slotted mask contoured to produce the constant noted above. It is mounted about the axis of rotation of the gimbal. The detector flake is located parallel to the mask (about three inches from the center of rotation) with its active surface aligned along a radius vector originating at the center of rotation. Most angular motion detectors are mounted perpendicular to the radius vector.

As the gimbal moves, light passes through the mask and strikes a section of the detector, the electrical output of which has been calibrated in terms of degrees of rotation. The system has a coarse range of from zero to $\pm 27°$ and a fine range of from zero to $\pm 7°$ with accuracies to $\pm 0.6°$. Also, the need for logic circuitry in the electronics portion of the system is reduced considerably.

Note:

Inquiries concerning this innovation may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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