NASA TECH BRIEF
Ames Research Center

Interferometric Rotation Sensor

The problem:

To detect rotation relative to the line-of-sight axis of a sensor that is pointed to a star.

The solution:

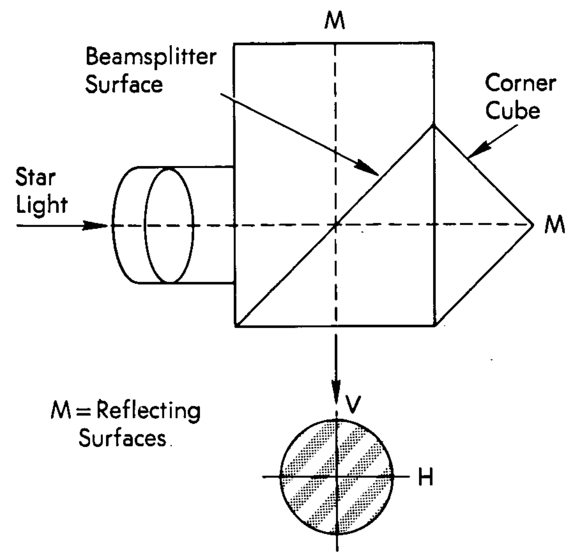
Generate interference fringes which vary in number (horizontally and vertically) as a function of the total angular deviation relative to the line-of-sight.

How it's done:

The sensor is constructed of glass for use with the visible spectrum, quartz for the ultraviolet regions, or calcium fluoride for the infrared, and is constructed as indicated in the diagram. The interfaces of the beamsplitter and the trihedral prism are cemented together to form one component; the three outer surfaces of the component are coated with high reflectance materials.

When a collimated beam of starlight is brought to the sensor by a suitable optical system, a fringe pattern is formed and can be examined at the exit pupil of the sensor. The pattern is projected onto an image dissector tube and the fringes are counted by horizontal and vertical sweeps of the tube face. The horizontal and vertical counts of the number of fringes are the basic data for error-signal generation.

When the optical axis of the sensor is in theoretically exact alignment with the beam of starlight, there will be no fringes either horizontally or vertically on the tube face. Pitch and yaw counts are zero and rotation deviations from the star beam are zero in pitch and yaw. The sensor is insensitive to roll about the star beam. Motion in pitch only will result in generation of horizontal fringes. Motion in yaw only will result in generation of vertical fringes. Any combination of pitch and yaw will cause apparent rotation of the fringes on the face of the tube. Vertical and horizontal scan counts will reveal the components of pitch and yaw leading to the number and inclination of the fringes which could be computed if total deviation and plane of deviation were desired as computed



data. Otherwise, the V and H scan counts serve as raw error signals for null tracking or pointing.

The sensor minimizes errors due to translations relative to the line-of-sight such as may occur because of vibration, thermal expansion or contraction of components, and creep due to mechanical distortion of components. It also eliminates errors from zero or null shift due to lack of stability of electrical circuitry from causes such as voltage variations, temperature changes, etc. The fringe counting operation is not as dependent on these parameters as are other techniques used to detect rotation.

(continued overleaf)

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Ames Research Center
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Reference: B72-10274

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Patent Counsel
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(ARC-10278)