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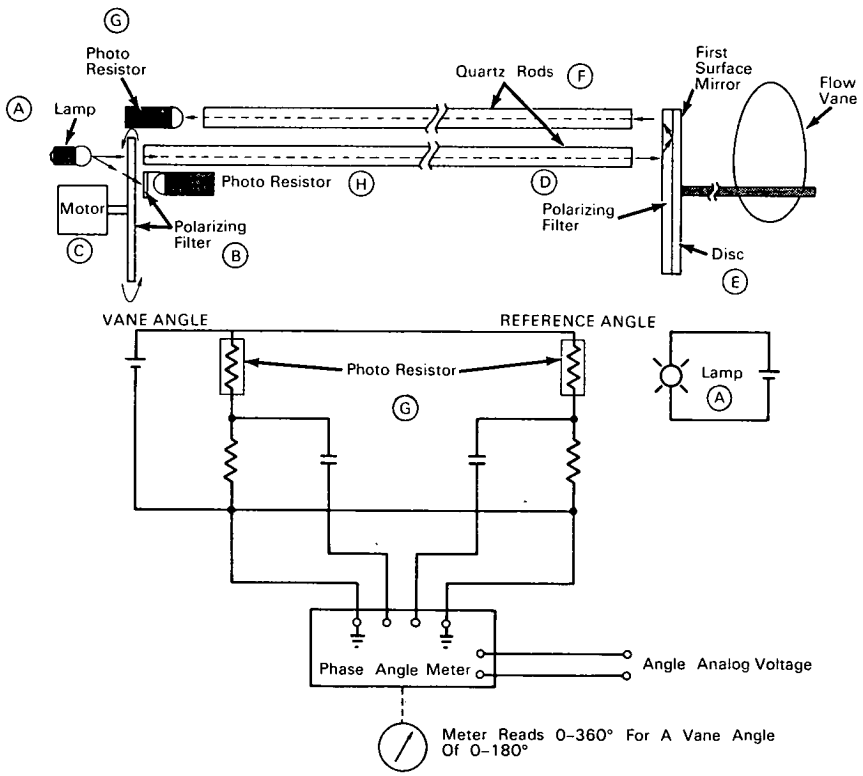
Brief 69-10050

NASA TECH BRIEF

Flow Angle Sensor and Readout System



A sensor has been developed for determining fluid flow angles by means of a simple vane whereby the vane positions itself in the direction of flow in the same way that a weather vane moves with the wind. As the vane moves, it rotates a small light-reflecting disc. The read-out system uses two beams of cyclically polarized light. One of these beams falls on a fixed polarized filter photo resistor; the other falls on a rotatable mirror (also equipped with a polarized filter) which is attached to the vane. The second beam is reflected from the mirror to a second photo resistor, the output of which is then compared to the output of the first photo resistor to determine the angle of the flow vane.

As shown in the figure, the system functions as follows:

1. Unpolarized light emitting from lamp (A) passes through a rotating polarizing filter (B) driven by motor (C). The light becomes polarized after leaving filter (B). Since filter (B) is rotating, the angle of polarization of the light follows the angle of rotation of the motor.

2. The angular rotating polarized light is projected into one end of quartz rod (D) and is directed through

(continued overleaf)

the rod to the flow vane's rotatable disc (E). This disc consists of a plastic polarizing filter bonded to a mirror surface. The flow vane rotates disc (E).

3. The angular rotating polarized light from rod (D) is, after passing through the polarizing filter of disc (E), reflected from the first surface mirror of disc (E) and enters quartz rod (F). Rod (F) carries the reflected light back to photo resistor (G).

4. When the instantaneous angle of light polarization from rod (D) equals the polarization angle of the polarizing filter attached to disc (E), the reflected light is maximum. The reflected light becomes minimum when the angle relationship is 90 degrees. With the system as shown, the reflected light intensity varies sinusoidally at two cycles per filter (B) revolution.

5. A system reference angle (sine wave) is produced by photo-resistor (H). A piece of polarizing film is attached to the sensing end of photo resistor (H) producing two cycles of light and dark exposure and subsequent resistance changes. Rotation of disc (E) over a range of 0–180 degrees directly shifts the phase angle relationship between the photo resistor circuits (G) and (H) over a range of 0–360 degrees. The flow vane angle is then readable as 1/2 the phase angle of these two signals by any phase angle meter and/or system.

Notes:

1. No additional documentation is available.
2. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B69-10050

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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