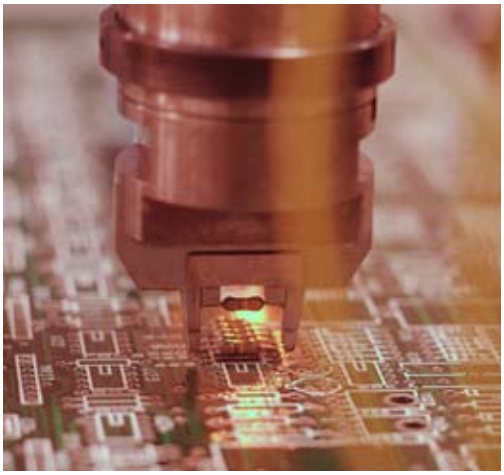
Sensor Technology

Low-Cost, Repeatable, Noncontact Absolute Linear Position Sensor and Limit Switch



NASA has developed an absolute position sensor that is elegant in both its approach and simplicity. The sensor uses an emitted low-frequency sinusoidal signal that is read by a detector, compared to other typical sensors that operate under optical or magnetic (Hall Effect) principles. The sensor is used for linear proximity detection and has a limit switch function incorporated into the design. The noncontact design enables long life (no degradation due to wear), repeatability, and imperviousness to grease and dirt.

Benefits

- Low-cost: Component costs estimated at $5
- Repeatable: Correlation of multiple runs is 0.999999
- Highly accurate: Maximum error of 3.7 microns; average error of 0.86 microns
- Small Form Factor: ~1.0”x 0.8”x 0.25”
- Versatility:
  - Built-in limit switch function
  - Option to incorporate emitter/sensor RF communications link
  - Can be housed in numerous configurations or embedded in other materials
- Absolute measurement: no calibration required for installation; accurate upon restart, even if system moved while power was cut off.

technology opportunity

For More Information

If you would like more information about this technology or NASA's technology transfer program, please contact:

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32224-1.

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The Technology

The sensor uses only two active components: an emitter that transmits the excitation signal and a detector. The sensor is composed of a set of electrical conductor coils flanking another electrical conductor coil and a ferromagnetic material that is aligned with and spans the combined coils. The emitter, spaced apart from the detector assembly, transmits a periodic electromagnetic wave toward the detector, which compares the relative properties of the emitted and received signals to determine the distance.

The typical travel for NASA's applications is 5mm, but the technology can be scaled for larger travel. Redundancy can be achieved by adding a second sensor in the same space. Any ferromagnetic material can be used for the sensor. For NASA's application Mu-metal, a very highly ferromagnetic material, was chosen to reduce the size of the sensor hardware.

Applications

The technology is suited for precise linear sensing tasks in a variety of industries. Examples of tasks and industries are listed below.

Tasks

- Pick and Place applications
- Object mating (using communications feature)
- Robotics
- Automated assembly
- Precision engine control
- Position sensing

Relevant Industries

- Industrial robotics for manufacturing fields such as semiconductor (wafer steppers, flat panel inspection), electronics, medical, plastics
- Machine tools (e.g., laser micro machinery, stamp press, woodworking)
- Materials testing
- Photocopiers
- Automotive
- Aerospace

Opportunity

NASA has obtained patent protection for the technology (US No. 7,116,098), has developed a prototype, and validated the performance in a laboratory environment. NASA is seeking commercial partners interested in licensing the technology for further development and commercialization.