National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Sensors

Flexible Body Control Using Fiber Optic Sensors (FlexFOS)

Sensors provide three degrees of freedom real-time structural dynamics and flexible body information

NASA Kennedy Space Center seeks partners interested in the commercial application of the Flexible Body Control Using Fiber Optic Sensors (FlexFLOS) technology. The FlexFOS measures flexible dynamic state through a reference strain structure (RSS) combined with fiber optic strain sensors (FOSS). This new system for strain measurement provides users with an exponential increase in the amount of dynamic data, affording end users with a more precise and accurate assessment of critical structural dynamics. When combined with an inertial measurement sensor, FlexFOS enables end users to separate out the rigid body and flexible body components of the total motion. KSC is now seeking commercial partners for licensing or further development of this novel sensor system.

BENEFITS

- Real-Time Structural Shape Sensing
- Increased Control System Robustness
- Increased Flight Margin Resolution Across Multiple Disciplines
- Potential Elimination of Conventional Aerodynamic Control Surfaces

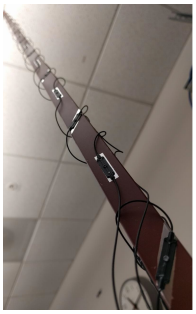
THE TECHNOLOGY

Aerospace vehicles experience flexible dynamics that have adverse effects on guidance, navigation, and control. Vehicles that include automated control are further affected by flexible modes and structural vibrations. Flexible dynamics become even more critical as demand for larger and more fuel efficient vehicles increases.

Using fiber optic technology to collect both flexible and rigid body information enables increased knowledge (data) of the state of a vehicle, a more robust collection method against weather conditions, and a more cost-effective measurement method. This technology could potentially be applied to aerospace vehicles as well as commercial space structures, commercial aerospace structures, cranes, buildings, or bridges - anything with a large cross sectional ratio.

The RSS is the key to developing a sensor which provides flexible body kinematics. A reference structure must be chosen that minimizes weight impacts while retaining structural integrity. The reference structure material must also be very predictable and repeatable. Once this geometry has been optimized, analyzed, and mapped it is integrated with strain sensors making it a Reference Strain Structure. The RSS must then be integrated into an adaptive structure, which both protects and provides a connection to the desired structure to be measured.

The RSS combined with the properly designed algorithms provides the capability and portability to be installed on any of the aforementioned structures alleviating unique engineering and calibration required for each structure or vehicle. It also provides the capability to employ actuators to counteract the effects of structural vibrations. FlexFOS provides a simple, portable solution adaptable to any structure.



Example Reference Strain Structure

APPLICATIONS

The technology has several potential applications:

- Government and Commercial Aerospace Vehicles
- Government and Commercial Space Structures
- Cranes
- Buildings
- Bridges
- Wind Turbine Blades

PUBLICATIONS

Patent No: 10,488,183

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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Agency Licensing Concierge

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