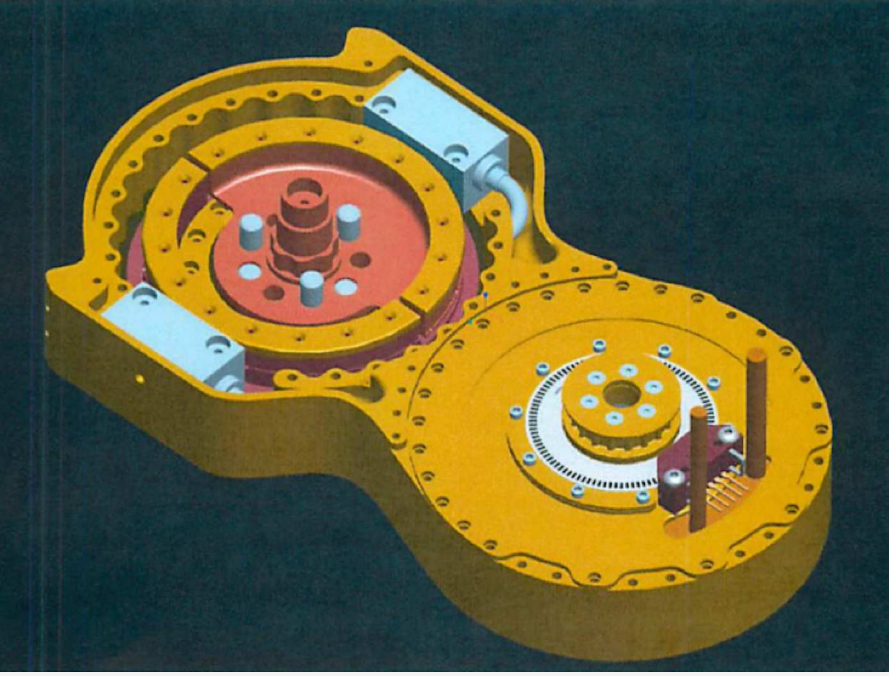

National Aeronautics and Space Administration

Sensors

Split-Ring Torque Sensor

An Optical-Based Device for Measuring Position, Velocity, and Torque

Innovators at the NASA Johnson Space Center (JSC), in collaboration with Oceaneering and The Florida Institute for Human and Machine Cognition, have developed the Split-Ring Torque Sensor (SRTS), a device that uses optical sensors to measure the position, velocity, and torque of a rotating system. The SRTS was created for use in NASA's X1 robotic exoskeleton, an in-space, wearable exercise machine designed to supply resistance against leg movement for NASA astronauts in future missions. The X1 exoskeleton implements the SRTS in its belt-drive series elastic actuator (SEA) and provides a lower profile and lower weight system than competing designs. The SRTS offers greater flexibility in tailoring for specific applications and requirements. In addition to its applications in robotics, the SRTS has potential uses in medical fields including prosthetics, aerospace & defense applications, automotive applications, testing & measurement, and industrial markets.

BENEFITS

- *Enables lower profile and lower weight:* similar technologies use stacked rotary position sensors, resulting in increased volume and stack height - SRTS enables systems to be thinner and lighter
- *Offers greater accuracy:* SRTS offers highly accurate position measurement and displacement measurement
- *Provides an adaptable system:* the split-ring design may also be employed in various configurations with different devices or sensors

APPLICATIONS

- Robotics
- Medical fields including prosthetics
- Aerospace & Defense
- Automotive
- Testing & Measurement
- Industrial Tools and Machinery

technology solution

THE TECHNOLOGY

The SRTS enables measurement of position, velocity, and torque of a rotating system (e.g., actuator, motor, crankshaft, rotor, etc.) using two optical sensors and a single, custom-designed split-ring rather than the standard dual-ringed systems commonly used for similar applications. The split-ring is comprised of two structural arcs positioned in a concentric, coplanar relationship, wherein each arc is attached to a component capable of rotation (e.g., a lower leg and upper leg, where the SRTS acts as a knee). The two arcs contain indications or codes on their outer surfaces that are read by the optical sensors to determine the relative deflection of the structural arcs as they rotate.

The SRTS configuration discussed above is limited to 180-degree applications. The addition of a third structural arc and a third optical reader, however, would enable 360-degree functionality.

Tests have shown the SRTS has a high degree of tolerance to temperature differences and provides higher resolution measurements than competing technologies.

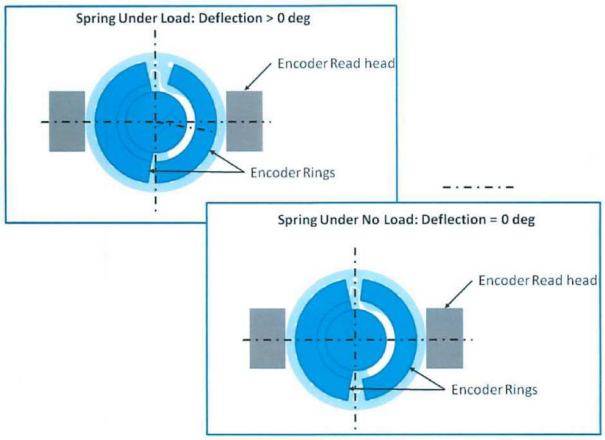

Diagram of deflected (top) versus a non-deflected (bottom) Split-Ring Torque Sensor

PUBLICATIONS

Patent No: 10293481

More Information

National Aeronautics and Space Administration

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