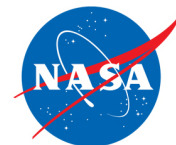




National Aeronautics and
Space Administration



TECHNOLOGY SOLUTION

Robotics, Automation and Control

Precision Low Speed Motor Controller

Inexpensive Low Speed Brushless DC (BLDC) Motor Controller

Innovators at the NASA Johnson Space Center have developed a method for controlling precise motion of a Brushless DC (BLDC) motor using relatively inexpensive components. Precision motors are usually quite expensive and inefficient when operating at slow speeds. This technology uses a method to control BLDC motors over a broad range of speeds, ranging from about 0.025 rpm to about 7000 rpm. Its ability to operate at these ranges and with high precision provides an opportunity to integrate this technology to many applications and industries. Commercial motors may employ this technology to extend their dynamic range. This technology can also be integrated into surgical robots that require advanced precision motion control systems. Hybrid and electrical vehicles can integrate this technology to their operating system to improve efficiencies.

BENEFITS

- Precise in Low Speed Motion: Smooth enough to be applied to surgical robots
- Efficient: Reduces noise associated with slow-motion operations
- Inexpensive: Able to perform same functions as more expensive motors



THE TECHNOLOGY

The Precision Low Speed Motor Controller was designed as part of an OpTIIX telescope for the International Space Station. This technology is based on a precise current control loop and a high fidelity velocity measurement algorithm. The precise current loop uses a mathematical model of the electrical dynamics of the motor, custom electronics, and a PI controller to maintain a rapid response and smooth current control. The velocity measurement algorithm is embedded in the velocity loop that is wrapped around the current loop to provide a smooth low velocity control.

Current motors are only capable of operating at approximately 15 rpm with a risk of excessive jitters. This technology reduces the responsive rpms by several orders of magnitude to approximately 0.025 rpms. This technology's capability has been integral to the success of several NASA projects, such as the OpTIIX telescope, the NASA Robonaut 2 robot, and the Modular Robotic Vehicle (MRV).



The Precision Low Speed Motor Controller can be integrated into Robots to conduct surgery.

APPLICATIONS

The technology has several potential applications:

- Robotic Systems: Precision low speed motion
- Motor Industry: Extension of the dynamic range
- Automotive Industry: Reduction of sensor noise on the system

PUBLICATIONS

Patent No: 10,884,012