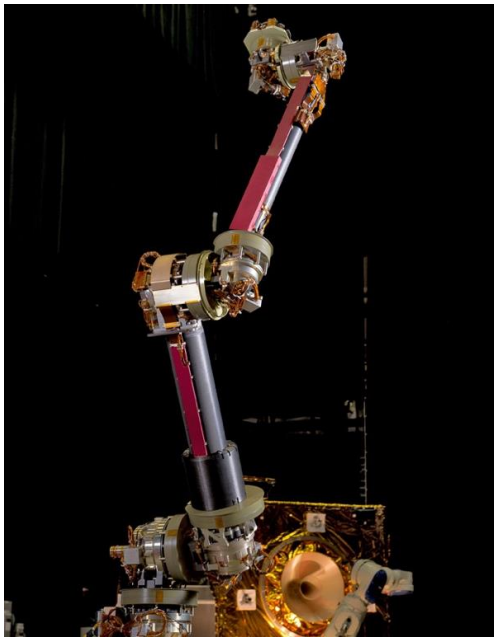
NASA Needs Sub Newton Force Torque Sensors



Name of Technology:
Robotic Sub Newton Adjustable Force Torque Sensors (FTS)

Participating NASA Centers:
JPL(Lead); ARC, GRC, GSFC

Technological Area:
4 Robotic Systems for Space Exploration

Vision for the Technology:
As humans live and work in space, on the moon, and Mars, robots will be needed more to help with a variety of task. Robots can be used to operating in environments too distant or hostile for humans. Humans will increasingly rely on versatile robots to perform routine activities, freeing humans to focus on more challenging tasks and/or decisions. Technologies are needed for robotic systems to improve on new sensing techniques/methods. Innovative robot technologies provide a critical capability for mobility, manipulation, and human-robot interaction to support human missions.

Robotic manipulation and sensing permits for the handling of tools, interfaces, and materials not particularly designed for robots. This may also provide other capabilities such task as drilling, extracting, handling, and processing samples of a variety of materials. This sensing innovation would increase the range of capabilities and task robots can accomplish across different mission situations.

Challenges:
Existing “end of arm” force torque sensors are not placed close enough to the sensing point to minimize the load distal of the sensor. They do not work in both unrestricted 1-g and 0-g environments. In addition, sensors cannot concurrently handle large (6-10x) full range overload from launch loads while providing absolute accuracy stability for at least 30 minutes before zeroing.

NASA Seeks to Meet the Following Specs:
A sensing technique is needed that can provide:

- Work in both unrestricted 1-g and 0-g environments
- Operate with large (6-10x) full range overload from launch loads
- Range of 0 to 200-500 N,
  - Resolution of 2 N resolution
  - Absolute accuracy of ±5 N for surface contact measurements
- Range of ±120 N,
  - Resolution of 1/5th to 1/10th N
  - Absolute accuracy of ±2 N for servicing tasks
- Range of 0 to 20 N
  - Resolution of 0.02 N
  - Absolute accuracy of ±0.1 N for payload determination measurements

Overview of Student Project:
Innovative sensors and/or techniques are sought by NASA to sense forces closer to the actual “end of arm” mechanism on robots. Enhancing the ability to accurately sense forces near the tactile device would significantly open the possibilities for robots to be invaluable and versatile.

Innovative Areas Student Projects Can Address:

- Innovative sensors and/or techniques to sense the “end of arm” mechanism objects and forces for versatile task.
- Withstand launch loads (3 to 10 g loads)
- Operate in1-g and 0-g environments
- Low weight and mass
- Continuous operation

Research Funded by NASA on this Topic:

Proposal Number: 21-1- Z3.05-2626
Robotic Arm Force Torque Sensing System (RAFTSS)

Proposal Number: 14-1 S4.02-9613
Robust Six-Axis Force and Torque Transducer

Proposal Number: 02-II H5.02-9632
Novel Force Sensor for Robotics

References:

S4.02 Robotic Mobility, Manipulation and Sampling

S13.01 Robotic Mobility, Manipulation and Sampling

Robust Six-Axis Force and Torque Transducer

ATI Developing Force/Torque Sensing Technology for NASA

ATI Force Torque Senor (video)