A VERSATILE ADVANCED PRECISION ROBOTIC SPACE MANIPULATOR FOR INS-SPACE APPLICATIONS.

SANDHYA RAO SREEMON CHOWDHURY

NOTION ROBOTICS LAB

SANDHYA RAO

NO 1025, SECTOR A VASANT KUNJ NEW DELHI-1100070

Sandya.rao@notionrobotics.com

MOBILE-91-7760881188

POSTER

KEYOWRDS- ROBOTIC SPACE MANIPULATOR, LONG REACH, TENDON ACTUATED, TENSION STIFFENING HINGE JOINT

As we advance towards space exploration missions, the growth and evolution of computer spacecraft and space exploration demands a fast advanced robust design mechanisms and development of highly intelligent automated system with artificial intelligence and light weight sophisticated modular, compact robot devices.

Notion Robotics lab is currently focusing on developing a joint prototype of new planetary surface hybrid lightweight manipulation system and to improve space manipulator state of the art by constant increase manipulator reach, dexterity and Packaging Efficiency while reducing manipulator mass and complexity.

The need for advancedDevices for lifting and transporting payloads and material are criticaly will be needed to support lunar-outpost construction, Satellite servicing, inspection, regolith excavation, grading and payload placement, Captuirng asteroids for infusion, large space observatory assembly,construction and other crosscutting in-space applications.

Notion robotics Lab has designed this exploration architecture for maneuvering and precisely placing payloads which could change the dynamics of the conventional manipulators to new novel in-space robotic manipulator. This research paper gives you an insight of a new innovative design architecture of space robotic manipulator which has unique key features and approach towards achieving a revolutionary performance in -space applications.

This new design arthitecture and research describes the concept , design and features of a lightweight , high strength, modular compact robot manipulator by development of High performance of Tension stiffened and Tendon Activated Manipulators with a novel hinge joint and light weight links for In-Space Applciations. This novel approach for Planetary mission requirements lead to specific desired features which have a large significant impact on operational implementation and design of a planetary precision surface manipulation system.

This research paper described here with a new hybrid class of manipulators . A n combination of both tension actuation of the manipulator and tension stiffening of the links are the novel approaches to space manipulator design. Here the tendon actuation incorporates spreaders for longer moments arms between the force applied and the joint rotation axis for generating moments and actuating the joints. The hinge joint architecture allows 360 degree rotation between connecting links thus capable to incorporate tension suffering and auxiliary. tendon actuation can be semi/fully antagonistic with major components bearing the spreaders, motors gearboxes links and cables, metallic tapes, . Tendon actuation The joint stiffness can be increased due to tendon architecture, lightweight joints is optimized to achieve efficient compact packaging, range of different motions, dexterity, high strength etc. The long reach manipulator is modular, easy to scale over a different ranges from 5 to 250 meters and the dexterity can be easily adjusted as the joints are lightweight. Actuating the manipulator joints using tension elements can compensate by the spreaders provides mechanical advantage thus enabling low precision motors thus reducing motor complexity and costs.

References

Hunter, J. A.; Ussher, T. H.; and Gossain, D. M.: Structural Dynamic Design Considerations of The Shuttle Remote Manipulator System. AIAA 82-0762, pp. 500 - 505.

2. Kumar, P.; Truss, P.; and Wagner-Bartak, C. G.: System Design Features of the Space Shuttle Remote Manipulator. Proceedings of the Fifth World Congress on Theory of Machines and Mechanisms 1979. Published by the ASME, pp. 839 – 842

. 3. Craig, John J.: Introduction to Robotics, Mechanics and Control, Third Edition. New Jersey: Pearson Prentice Hall, 2005. 4. Doggett, William R.;