

HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)  
Joint session on Human and Robotic Partnerships to Realize Human Spaceflight Goals (3-B3.6)

Author: Mr. Liangliang HAN  
Institute of Aerospace System Engineering Shanghai, CASC, China, hllrob@163.com

Prof.Dr. CHEN MENG  
Aerospace System Engineering Shanghai, China, China, workmailcm@126.com

Dr. HU Bingshan  
China, icebergh@126.com

Mr. TANG PING  
China Aerospace Science and Technology Corporation (CASC), China, tangping219@sohu.com  
Zhang Chongfeng  
Shanghai Academy of Spaceflight Technology (SAST), China Aerospace and Technology Corporation  
(CASC), China, huangpeng301@hit.edu.cn

A NOVEL FOUR-ARM SPACE ROBOT FOR ON-ORBIT SERVICING ON LARGE-SCALE  
SPACECRAFT

**Abstract**

Constructing in-space infrastructure like space station, space fuel-station or space solar station will be a significant way to detect and make use of the resource in outer space. The apply of space robot will relieve astronauts of operation burdens and reduce the risk of extravehicular activity in the process of assembling, repair and maintenance of these large-scale spacecrafts. This paper proposed a novel four-arm space robot for on-orbit servicing on large-scale spacecrafts, which could climb on the surface of the spacecraft and do some dexterous operation. It's a redundancy robot with four identical arms. Each arm is equipped with seriation end-effectors or dexterous humanoid hand to satisfy the needs for repair or grasping. Drawing on the movement pattern of the creatures with four limbs, the robot has multiple climbing strategies and gaits to achieve a large coverage of the spacecraft. With the help of the humanoid hand, the robot gains the operation ability similar to the astronauts. According to the task analysis and bionics, the configuration of the robot is established and the mathematical model is built. The practicability and advancement are verified with the simulation of climbing and operation.