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Author: Dr. Jie Liang
China, myamoy81@sina.com

Ms. Pin Liang
China, lpin3977@sina.com
Prof. Li Chen
Fuzhou University, China, Chnle@fzu.edu.cn

# FREE-FLOATING FLEXIBLE SPACE-BASED ROBOT DURING CAPTURE SATELLITE AND NONSINGULAR TERMINAL SLIDING MODE CONTROL FOR COMPOUND BODY STABLE MOVEMENT BASED ON FUZZY NEURAL NETWORK

**Abstract**

This paper discusses stability control problem for compounded body of flexible space-based robot and target satellite after capturing operation is completed. The dynamical model of the flexible space-based robot system is derived with Lagrange formula, and the dynamical model of the satellite is derived with the Newton-Euler method. And based on it, coupling momentum and impulse transfer during operation p flexible rocess of space-based robot to capture the target satellite, mathematical models which been suit for the design of control system that for free-floating space-based robot to on-orbit capture floating satellite are established. Using said mathematical model, a nonsingular terminal sliding mode control algorithm based on fuzzy neural network is proposed. The control algorithm is comprised of a nonsingular terminal sliding mode control, fuzzy neural network adaptive control and robust control. So the control algorithm sets advantages of nonsingular terminal sliding mode control, fuzzy neural network adaptive control algorithm and robust technology, and the three algorithm's disadvantages are offset. The mentioned control algorithm needs neither to parameterize the dynamic equations of the system linearly, nor knows any system parameters. For using self-learning capability of neural network to modify control rules of fuzzy control and membership functions, so that in the identification of system parameter, fuzzy neural network can reduce the number of fuzzy rules, it may be more adapted for practical application of space-based robot system to on-orbit capture. A complete analysis on the stability and the performance are performed by using Lyapunov theory. The correctness and applicability of the control scheme are manifested by simulation and experiment. This paper work is supported by the National Natural Science Foundation of China (Grant No.11372073)