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SPACE MANIPULATOR ON ORBIT CLEANING SOLAR PANELS OPERATION BASED ON BIAS NEURAL NETWORK FORCE/ POSITION CONTROL

Abstract

Solar panels are the power supply equipment of the satellite system. If the power supply cannot maintain the routine operation of the electronic equipment in the system, the satellite will lose efficacy, which is also the main factor limiting the life of the satellite. The smoke generated during satellite attitude adjustment is easily attached to the solar panel, leading to a decline in the power supply capacity of solar panels. Therefore, it is of great significance to use the space manipulator to clean the solar panels regularly to extend the service life of the satellite. Because satellite solar panels are generally cantilever beams, if the space manipulator is used to clean the solar panel, it is essential to control the posture and output force of the cleaning device with high precision, which considerably increases the difficulty of this research. Firstly, the dynamic model of the space manipulator system with satellite attitude controlled is established. The kinematic relationship of the cleaning device is established by using the kinematic constraints of the cleaning device in the satellite coordinate system. Then, to realize the precise control of the output force during the cleaning operation, the impedance model of the space manipulator is established according to the dynamic relationship between the cleaning device posture and its output force based on the principle of impedance control. An approximate switching control based on Bias RBF Neural Network (BRBFNN) is proposed. Compared with RBF Neural Network (RBFNN), the controller with BRBFNN can push the input signal back approximation domain when the inputs deviate from the approximation domain because of the enormous dynamic deviation of the manipulator system. It improves the robustness of the adaptive RBFNN controller further. The adaptability of the controller to the uncertain parameters is also enhanced by approximate switching gain. Finally, the stability of the system is proved by Lyapunov principle, and the effectiveness of the proposed control strategy is verified by simulation analysis.