SPACE OPERATIONS SYMPOSIUM (B6)
Mission Operations, Validation, Simulation and Training (3)

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ASTRONAUT OPERATION SIMULATION IN SPACE STATION BASED ON VIRTUAL REALITY

Abstract

Astronaut operation simulation was widely used for verification in phase of project scheme and operation familiarization training in phase of mission preparation. In order to simulate the complex operations of the astronaut in space, various kinds of typical operation of astronaut in space station was analyzed, including: grasp-transfer-release object, open/close cabinet door, push/pop drawer etc.. Two-tiers model structure was designed, one was used for collision detection and operation simulation, and driven by VR device data; another was used for graphic display and driven by the result of the first layer simulation. Objects operated by astronaut were classified into different types by its freedom of movement such as objects which moved to any position and orientation, cabinet door which rotated by the fixed axis in a range of angle, drawer which moved along one direction in a range of distance. An algorithm was proposed for real-time simulation to fastly search for object which hand will be mostly operated from many objects, to fastly complete collision detection between object and fingers of hand with many triangles, and to fastly determine whether the hand stably grasp object in grasping process by simply grasp rules. One application system which demonstrated the operation simulation in space station was developed, which used the VR device Cyber Glove and Flock of Birds to track motions of fingers, arms and trunk of the trainee. The system provides an effective technical approach and basic algorithms for astronauts to participate in the project design of the early stage and space operation simulation training in mission preparation in subsequent manned space mission