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UNDERWATER AND WEIGHTLESS TYPICAL EVA MOTIONS SIMULATION

Abstract

For extravehicular activities (EVA), astronauts are trained in the Neutral Buoyancy Lab. But there are dynamics differences between underwater and weightless environments. How about those differences influence on the astronauts' motions and joint torque? This paper researched this problem by simulation using the multibody dynamics software ADAMS. A seven-segment EVA spacesuited human model was developed. The modified form of the Morison's equation was used to evaluate the hydrodynamics resistance. Then focusing on the dynamics differences of the two enviroments, thirteen typical EVA motions of astronauts on the Shenzhou-7 spaceship of China were comparatively simulated, some joint torque at limbs doing those motions were numerically measured. By simulation, we discovered that the joint torque was larger in underwater than in weightless environment several times even several decuple. The research results were applied to coach Chinese taikonauts. The motions doing which joint torque differed greatly were selected and trained importantly. The trained taikonauts were required to regard those motions more and do slower with small strength. Taikonaut Zhai Zhi-gang well controlled his body and moved smoothly when space walking, that proves the value of the research.