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FEATURES OF ADVANCED EVA SPACESUIT GLOVES DESIGN

Abstract

Extravehicular activities (EVA) are an essential and important part of manned missions. Its role in future space exploration, including interplanetary flights, will grow, as such space missions will request more human involvement and therefore more operations: not only maintaining activities aiming to provide a space station sustainable operability but deep space exploration. This work indicates challenges of EVA activities, analyses and summarises typical operations in the spacesuit and its application to future missions. Success of manned missions and high performance of human in it depends on astronauts working capability where the spacesuit ergonomics plays a crucial role and this paper discusses the EVA spacesuit ergonomics and its features: an ergonomic spacesuit should be comfortable, prevent injuries and provide high flexibility, which may be reached by using different elastic materials, correction of the fit, providing special structural elements helping to support motions. Especially these parameters become important in case of excessive pressurisation as it significantly limits a range of motions. This study offers to install special electronic elements allowing astronauts to control their movements easier with higher comfort and less efforts. The glove is one of the most important elements of the spacesuit especially from the point of view of flexibility. This paper is dedicated to the analyzes of technologies used in the gloves design with regards to its ergonomics and application to future missions. This paper gives an overview of restrictions and limitations on the gloves design. An analytical model of the hand dynamic in the control loop during operating is offered based on kinematics of human hands and rigidity characteristics of the gloves. The feasibility of installation of a built-in manual exoskeleton that may overcome the stiffness of a spacesuit under the pressure is discussed as one of perspective solutions.