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Author: Dr. Yuanding Wang
Shanghai Institute of Space Propulsion, China, wyd19870328@163.com

STUDY ON THE EXPERIMENT OF PROPELLANT REFUELING BASED ON SATELLITE PROPULSION SYSTEM.

Abstract

Since the first satellite was sent into space by the Soviet Union in 1957, humans have launched a large number of high-value spacecraft into orbit. With the gradual consumption of the propellant, a large number of spacecraft have to end their life in the case of they can still continue to work, which seriously reduces the value of spacecraft. How to extend the on-orbit life of spacecraft has become the research hotspot in various spaceflight countries. The propellant refueling technology is an effective way to solve the long-term on-orbit of spacecraft. The on-orbit refueling technology based on the space station is very mature, and Russia has already realized the engineering application. In April 27th 2017, the Tianzhou-1 cargo spacecraft and Tiangong-2 space laboratory successfully completed the first on-orbit propellant refueling test, which marked that China has successfully break through and mastery the on-orbit propellant refueling technology based on the space station. However, the on-orbit propellant refueling technology based on satellite propellant system has not yet been applied in engineering. The United States is in the leading position in this field and has carried out a large number of experimental research, which has laid a good foundation for engineering application. In order to meet the urgent need of the on-orbit propellant refueling technology for the economical and efficient on-orbit operation of the orbiting spacecraft, the research of the on-orbit propellant refueling technology is carried out in this paper. An on-orbit propellant refueling ground test system for a variety of refueling modes was designed, and the ground demonstration verification test was carried out. The experiment of floating coupling connector and air tight, air cushion compression refueling, air cushion exchange refueling, pipe residual liquid blowing, high pressure gas addition and floating coupling separation have been successfully carried out. For the air cushion compression refueling experiment, the maximum refueling flow rate was 100 mL/s and the maximum refueling amount was 35.6 L, which is 71.2