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DEVELOPMENT OF THE DIGITAL TWIN FOR SMALL SATELLITE TQ-21

Abstract

With the development of modern small satellite technology, satellites play more and more important roles in remote sensing, broadband communication, navigation and scientific research. In recent years, the large-scale constellation plans are put forward continuously, SpaceX, Oneweb and Amazon have announced their large-scale broadband internet satellite constellations. Stimulate by commercial capital and market, the satellite industry develops fast. Low cost, short development cycle, digitalization, networking and intelligence become its trend. The mode of design, manufacture and operation of satellites (constellations) need to change at the same time. Digital Twin is a cutting-edge technology that has revolutionized the industry by mirroring almost every facet of a product, process, or service. It has the potential to replicate spacecraft in the physical world in the digital space and provide developers with feedback from the virtual world. As a result, the technology enables developers to quickly detect and solve physical problems, design and build better spacecrafts, and realize value and benefits faster than previously possible. Furthermore, the Digital Twin technology helps to improve the development processes and performance of small satellites. In this article, we developed a digital twin system for the small satellite TQ-21, the digital twin system consisted of satellite models, database, running environment and communication interfaces between the digital twin and the physical satellite. The digital models are developed using C/C++ and Creo tools. Based on the digital twin system, we could simulate the state of TQ-21 satellite in orbit by configuring parameters and status. With the digital twin, it is easy to optimize and estimate the operation state and system design. For new missions, we could build the digital twin of the new missions and evaluate the technology feasibility by configure corresponding parameters. The digital twin is also useful for new staffs to learn the composition and principle of satellites.