IAF SPACE POWER SYMPOSIUM (C3)
Solar Power Satellite (1)

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A MULTI-SYSTEM MULTIDISCIPLINARY INTELLIGENCE COLLABORATIVE OPTIMIZATION STRATEGY FOR SPACE SOLAR POWER SYSTEMS

Abstract

Since the concept of Space Solar Power Systems (SSPS) proposed several decades ago, many examinations and basic studies on the SSPS were performed in many countries. Various designs have been developed and the corresponding challenge technologies have also made great progress. As an extremely complex ultra-large space facility, the SSPS contains multiple subsystems, which are closely related to and influenced by each other, and involves many disciplines, such as machinery, electronics, thermal, control,etc.. Therefore, how to balance both the subsystems and the disciplines in order to expect an optimal design for SSPS is becoming one of the most important and challenging technologies during the design process.

This paper presented a multi-system multidisciplinary collaborative intelligence optimization strategy, aiming at simultaneously achieving the minimum total weight and the maximum power generation efficiency for the SSPS. The proposed strategy considered such several subsystems that their change would greatly affect the total weight and power generation efficiency of the SSPS, i.e., structure and control subsystem, energy collection and conversion subsystem, wireless energy transmission subsystem, etc.. The essential parameters of each subsystem and the coupling relations among them have been identified. The effect of these parameter changes on total weight and power generation efficiency has also been indicated. After collaborative optimization iterations, a balance is finally set up between the minimum total weight and maximum power generation efficiency. The 1MW demonstration system of the Multi-Rotary Joint SPS (MR-SPS) proposed by Dr Hou et al. in 2015 has been adopted as a case study.