IAF SPACE PROPULSION SYMPOSIUM (C4)
Virtual Presentations - IAF SPACE PROPULSION SYMPOSIUM (VP)

Author: Mr. WANG Chunmin
Northwestern Polytechnical UniversityNPU, China

Mr. Jian ZHAO
Xi'an Aerospace Propulsion Institute, China
Prof. Yonghua Tan
Academy of Aerospace Propulsion Technology, China Aerospace Science and Technology Corporation (CASC), China
Mr. GAO Yushan
Xi'an Aerospace Propulsion Institute, China

RESEARCH AND APPLICATION ON THE INNOVATIVE DESIGN SYSTEM OF LOX KEROSENE ENGINE WHICH IS AVAILABLE TO ADDITIVE MANUFACTURING TECHNOLOGY

Abstract

With the manufacturing mode of "model dimension reduction and integral processing", the additive manufacturing (AM) technology releases the restrictions of manufacturing process effectively, and makes it more possible to get the design of function priority. In recent years, a large number of successful applications of AM in the field of liquid rocket engine reflect its technical characteristics, such as digital, rapid manufacturing, low cost and insensitive to complexity. China's R D team of LOX kerosene engine has carried out the exploration and application of AM technology for several year, some of the applied products have passed the hot tests and flight assessments. In the process of application, we are aware that for achieving the deep integration of AM and liquid rocket engine R D system, one of the most important way is to develop the R D system which is matching with AM technology. This article will focus on the work we have done to utilize the AM technology in the LOX kerosene engine R D system effectively. First, the application of AM technology in the development of liquid rocket engine around the world is introduced, and the technical advantages and problems of AM application are analyzed as well. Second, from the perspective of R D oriented to AM technology, the exploration and research work carried out by our team are discussed. With the help of non-metallic 3D printer machine, we could make the rapid iteration of the whole design scheme, as well as the advance evaluation of manufacturing and assembly process. We have established an evaluation system to estimate whether the design is suitable for AM from the perspectives of material, size, cost and production cycle comprehensively, and the corresponding design principles which cover function-integration, structural-lightweight, AM forming process requirements are formed to help the designers obtain innovative, practical and feasible design schemes. In addition, we conduct the research of forming process and post-treatment with the AM department simultaneously, which is aim to ensure the success of the design scheme in once and avoid the scheme repetition. Finally, based on the strategic development plan of digitalization, informatization and networking of China's industrial system in the future, the significance of deep integration of AM technology and liquid rocket engine R D system is discussed, and the further research work we plan to implement are presented as well.