

SPACE PROPULSION SYMPOSIUM (C4)  
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Author: Dr. Yuanqi Li  
Xian Aerospace Propulsion Institute, China, liyq1\_casc@163.com

Mr. Hongjun Liu  
The 11th Institute of China Aerospace Sc. & Technology Corp., China, liuhj2003@263.net  
Prof. Xu Haohai  
Xi'an Aerospace Propulsion Institute, China, Xuhaohai\_11@163.com

## STATIC CHARACTERISTIC ANALYSIS OF 180KN LOX/KEROSENE UPPER STAGE ENGINE

**Abstract**

System static characteristic simulation is critical for the performance analysis of liquid rocket engine (LRE) and pre-design activities in particular. Analysis tool is a fundamental instrument along the entire design period from pre-design phase to parametric studies from tuning of the engine parameters. During the engine working process, interfering factors which will cause the engine parameters off-design conditions cannot be ignored. YF-115 engine, based on LOX/Kerosene staged combustion cycle, designed by Xi'an Aerospace Propulsion Institute is the upper stage engine of Chinese new generate launch vehicle Long-March 6 (CZ-6), which has been successfully launched in Sep.2015. A new non-linear static characteristic simulation model for YF-115 is established in this paper. Compared with the old one, combustion chamber (CC) and gas generator (GG) performances are estimated using the NASA code Chemical Equilibrium with Applications (CEA) instead of looking up standard gas table. Broyden quasi Newton method is used to solve the non-linear algebraic equations. As a validation, comparison of the main engine parameters (such as chamber pressure thrust and rotation rate etc.) is carried out between the trial run measurement data and the simulation result. Results reveal that calculation stability and accuracy are greatly improved by the new algorithm. Furthermore, the influence of the interfering factors (instability of inlet pressure or pump efficiency for instance) on the engine parameters is analyzed. The results obtained can be used for the analysis of rocket engine test results, the reliability and faults analysis, and also for revealing the variation law of the engine parameters with various interfering factors.