SPACE PROPULSION SYMPOSIUM (C4)
Poster Session (P)

Author: Mr. Sangbok Lee
Inha Univ., Korea, Republic of

SYSTEM ANALYSIS PROGRAM OF LIQUID PROPULSION SYSTEM FOR LAUNCH VEHICLE

Abstract

In this study, the program for analysis liquid propulsion system of launch vehicle has been developed. This program includes optimization process for suggesting the basis of minimum launch vehicle initial weight which satisfies target velocity and altitude.

The liquid propulsion analysis program has been developed using module programs of each part such as main thrust chamber, gas-generator, propellant tanks, pipes, valves, turbo-pump and turbines. This study develops analysis modules for classifying components of a liquid rocket engine and computing performance and weight of each component. Each module analyzes with combinations of the input and output for system analysis. In order to increase fidelity, the modules are based on not only empirical formulas, but also theoretical and practical data. Since all components in a liquid rocket engine are interconnected by using fuel/oxidizer and combustion gas as working fluid, pressure and mass flow of the single component affect the other elements. Therefore, balancing mass flow and pressure but also energy balance condition between a turbo-pump and a turbine are needed with satisfying user inputs. Analysis shows results with the error of 1 3

Using a genetic algorithm, optimization program has been designed to find the minimum weight of the launch vehicle within a range of design variables. The objective function was built up to maximize thrust to weight ratio of launch vehicle with target velocity and altitude. Trajectory, structure, aerodynamic analysis modules are regarded as simple equations to verify program process that will be replaced with higher-fidelity analysis program modules. As the program execution results, 8 10

This program is expected to be adopted in launch vehicle conceptual design process to find most efficient design with other disciplinary programs such as aerodynamic, structure, and cost.