SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (3)

Author: Ms. Joy Amedu
National Space Research and Development Agency (NASRDA), Nigeria, joyamedu@yahoo.com

Dr. Charles Osheku
National Space Research and Development Agency (NASRDA), Nigeria, charlesosheku2002@yahoo.com
Mr. Moshood Adetoro
National Space Research and Development Agency (NASRDA), Nigeria, adetoro3@yahoo.com
Mr. BHAR ALIYU
National Space Research and Development Agency (NASRDA), Nigeria, sk_bhar@yahoo.com

OPTIMIZATION OF ASCENT TRAJECTORY AND MASS BUDGET PREDICTION FOR A LOW POWER EXPERIMENTAL ROCKET

Abstract

The paper presents numerical results of a study concerned with simultaneous optimization of the ascent trajectory of an aerospace vehicle and propellant mass budget. A nonlinear aerospace vehicle was modeled in Simulink, and a MATLAB Graphical User Interface (GUI) was developed for the propellant budget estimation. The models implemented relates empirically to the mass interrelationship among various propulsion subsystems as a function of velocity at the end of the trajectory.

The vehicle under consideration is modeled as a rigid body and its motion restricted to two degree of freedom. While the mass budget model involves empirically related mass inter relationship among various propulsion subsystems as a function of velocity at the end of the trajectory. The range of the trajectory and other performance index(s) were also evaluated.

The research is intended to implement a design process for trajectory optimization and propulsion systems mass budget estimation for preliminary analysis and study at the Centre for Space Transport and Propulsion, Epe, Lagos, Nigeria. In addition, Mass budget predictor is designed and implemented as a tool to perform quick structural and propulsion mass budget and evaluation. It also in one stroke gives a vivid picture of a good design against a bad design.

Keywords: Trajectory optimization, launch vehicles, mission analysis, ground trace, coordinates systems, mass budget