

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

Author: Mr. Arseniy Pavlov
Bauman Moscow State Technical University, Russian Federation, pavlov_arseniy@mail.ru

Ms. Maria D'yachenko
Bauman Moscow State Technical University, Russian Federation, s_masyanya@mail.ru

LATERAL-STAGING SPACE LAUNCH VEHICLES DYNAMICS WITH ALLOWANCE FOR
PROPELLANT CROSSFEED

Abstract

Improving energy mass performance of launch vehicles is one of the most important research areas in rocket science. The general possibility to increase launch vehicle performance is usage of the most energy containing propellant components. Also maximum cutting speed depends on the optimal propellant distribution per stage. The most optimal launch vehicle configuration is the tandem-staging launch vehicle. But this scheme has some technical disadvantages in comparison with lateral-staging launch vehicle. The nonoptimality of the lateral-staging launch vehicle appears because the second stage begins its individual flight with half-empty tanks. The way to solve this problem is the propellant crossfeed between the first and the second stages during its joint flight. Despite the complexity of this process it can be implemented on the modern lateral-staging launch vehicles. The main crossfeed usage difficulty manifests in the dynamics of launch vehicle disturbance motion. Besides the fact that the dynamics of lateral-staging launch vehicles is insufficiently investigated and it's almost no information in open sources, propellant redistribution makes strong impact on the launch vehicle dynamics and requires its detailed research. In this work the mathematical model of the launch vehicle disturbance motion was proposed, stability regions was built and analyzed. Also considered some other issues of design and design parameters of lateral-staging launch vehicles with the propellant crossfeed between stages.