

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

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SEMI-ANALYTICAL METHODS FOR RAPID PRE-DIMENSIONING OF LAUNCHER STRUCTURES
SUBJECTED TO BOOSTER LOAD INTRODUCTION

Abstract

Launchers like Ariane 5 or Ariane 6 are subjected to large load introduction due to the Booster loads. The decaying of the warping stresses is depending on the orthotropic stiffening and is effective over large parts of the launcher. At the beginning of the development the structural design has to be elaborated in order to meet mass and cost targets. A huge amount of investigations has to be performed to considering different configurations and designs. The preliminary design is based on mass optimization studies. In order to manage the huge amount of analyses and variables, rapid analysis methods for stress and stability prediction are required. Semi-analytical methods have been developed and will be presented. These approaches have been applied on the Ariane 6-design and demonstrate their accuracy and applicability. The approach uses macro-elements of curved orthotropic panels enclosed by discrete ring frame stiffeners and discrete stringers. Arbitrary stiffened non-axisymmetric cylindrical shells can be analysed by this way. It turned out that the here presented method is significant faster compared to the classical Finite-Element method, which is essential for optimization studies.