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MULTIDISCIPLINARY DYNAMIC SIMULATION STUDY ON VTVL ROCKET LANDING MANEUVERING BASED ON MODELICA

Abstract

A VTVL reusable rocket is a complex engineering systemand its landing maneuvering is a typical multi-domain problem. The problem is full of jumbled coupling relationships, among those variety specific dynamic domains and subsystems, which are aero dynamics, propellant feeds system, propulsion system, attitude control system, multi-flexible-body dynamics, structural dynamics ,etc. The complexities of such couplings are instantiated in several aspects, a)The interactive interfaces among those domains and subsystems are abound,which means it is difficult to gathering modeling and maintaining such interfaces. Meanwhile, any change of any domain may influence other domains and causing lots of updating and verification works to do for all those models. b)These complex couplings may cause crossing algorithm loops, which can not be handled by traditional methods for ODE modeling, especially for fluid-transmission system and close-loop mechanism. Algorithm loops come from physical characteristics of variety domains, other than defective numerical modeling methods, and can not be easily removed, by using modeling tricks. Thus, a modern and unified modeling language is required, basing on which, building and solving a DAE based complex system can be achieved. The modeling language 'Modelica' is designed to modeling such complex system. And in this paper, an object-oriented , DAE based modelica library is introduced for the mentioned VTVL rockect system.