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INTEGRATION OF GUIDANCE SYSTEM WITH MODEL REFERENCE ADAPTIVE CONTROL FOR A RE-ENTRY SPACEPLANE

Abstract

A trajectory-planning algorithm is used in a guidance scheme for the Terminal Area Energy Management (TAEM) phase of an unpowered reusable launch vehicle that has already been constructed. This paper proposes new methodologies to integrate an existing Trajectory Planning Algorithm and Control algorithm for the guidance system of a re-entry spaceplane in TAEM phase. The trajectory algorithm optimizes the trajectory based on dynamic pressure profiles, bank angle, ground track predictor. The trajectory planning algorithm consists of guidance for vertical motion and guidance for horizontal motion. The vertical guidance scheme relies on prespecified dynamic pressure profiles, and the horizontal guidance scheme relies on a ground track geometry. The control-algorithm design is based on Simple Adaptive Control (SAC) theory, which aims to track the output of a reference model. The reference model is a linearized state-space description of a non-linear re-entry vehicle with an output feedback controller to keep it stable. The vertical and horizontal guidance scheme is integrated into combined control algorithm using Model Reference Adaptive Control Techniques. The integration and corresponding demonstration of the combined algorithm in a simulated flight of HORUS-2b is conducted in MATLAB and Simulink programming.