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Author: Mr. Francesco Torre
Mantu Group, Italy, francescotorre89@gmail.com

Prof. Fabio Curti
Sapienza University of Rome, Italy, fabio.curti@uniroma1.it

SUB-OPTIMAL THRUST MODULATION ALGORITHM FOR AUTONOMOUS SOFT LUNAR LANDING

Abstract

This work presents an algorithm for the 6-DoF guidance and control for the final descent of a Lunar lander with a non-throttleable engine. At first, the 3-DoF landing problem, defined by the initial state of the lander, the desired landing site and the time of flight needed to complete the manoeuvre, is set and solved using a quadratic programming approach. The resulting control sequence is, then, converted to a series of pulses by a Pulse Width Modulation (PWM) algorithm that takes into account the variation of mass of the lander during the descent. The attitude dynamics is included at this stage and a suitable sequence of rotations, needed to orient the lander before each ignition, is determined. The final control sequence is obtained modifying the results of the PWM in order to fulfil the time constraints of the attitude variations and to achieve a safe soft landing. The proposed guidance and control algorithm is tested to evaluate its performances and its capabilities of handling one or multiple retargeting are assessed.