BALLISTIC MISSILE TRAJECTORY DESIGN CONSIDERING IMPACT ANGLE CONSTRAINT

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Abstract

The current paper investigates the problem of guiding ballistic re-entry vehicles to the terminal point under the additional terminal constraint of final flight path angle. In this regard, the classical Lambert's Problem is reformulated to include the final flight path angle constraint. The proposed solution of the modified Lambert's problem consists of a minimum of two different trajectories starting from the same initial location and intersecting each other at a location, which is determined by applying the desired time of flight and terminal flight path angle constraints. The modified Lambert strategy strategy is shown to satisfy terminal flight path angle constraint along with the time of flight, initial and final location constraints. This scheme requires the ballistic vehicle to perform an additional stage burn during descent in-order to switch from an initial trajectory, using Lambert strategy, to a final trajectory which satisfies the final flight path angle constraint. An additional stage burn is provided such that the position and velocity of the vehicle traveling in the initial trajectory is matched with that required for it to be on the final trajectory. It is also found that the amount of propellant required for the trajectory transfer, is dependent on the total time of flight and the altitude at which the additional stage burn occurs. The optimal values of these two parameters are found using interior-point optimization technique.