Research Project 2: Optimal Linear Quadratic Powered Descent With An Intermediate Point

Student: Or Nataf * and Advisor: Vitaly Shaferman †
Technion - Israel Institute of Technology, Haifa 3200003, Israel

In the current study, we developed an optimal-control-based power descent guidance law, which enables soft landing while passing through an intermediate point. We employed 3D point mass dynamics with a constant gravitational field, and a closed-form solution was deraived for a quadratic cost function on the terminal miss, intermediate point miss, terminal velocity error, and the control effort. The derived analytical solution allowed performance prediction (i.e., control effort, propellant consumption, miss distance, and terminal velocity) and permitted an efficient parametric investigation. Adding an intermediate point to the optimization can be used to control the terminal approach direction and to avoid ground collision. The derived guidance law was evaluated in a realistic simulation and demonstrated very good performance.

*Graduate student, Faculty of Aerospace Engineering. E-mail: ornataf@campus.technion.ac.il
†Associate Professor, Faculty of Aerospace Engineering. E-mail: vitalysh@technion.ac.il.