Research Project 2: Hypersonic Boost-Glide Vehicle Interception

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The objective of this project is to find a strategy for the interceptor of a hypersonic boost-glide vehicle (HGV). The interception strategy was developed by first generating optimal divert trajectories for the HGV. The optimization is applied to the gliding phase. Based on these trajectories, the interceptor is aimed at a virtual target located on an intermediate trajectory between two extreme cases: the "maximum divert" trajectory and the "immediate divert" trajectory. The interceptor follows an optimal trajectory to this virtual target. As long as the HGV does not head toward its target, the intermediate trajectory, on which the virtual target is located, will continue to be updated. Once the HGV heads toward its target, its trajectory is determined, and the interceptor will switch to engage the real target. Using the location of the virtual targets' interception, a guidance law based on interpolated interception points is derived. The interceptor then solves an optimal control problem to this predicted intercept point (PIP). The trajectory optimization problems for both the target and the interceptor are solved using a hp-adaptive pseudospectral method based on the Legendre-Gauss-Radau collocation approach. The optimization is carried out in 3D, assuming a non-rotating spherical Earth. This project is a step towards a one-sided pursuit-evasion solution involving a Hypersonic Boost-Glide Vehicle.