# Target Interception with Time Varying Acceleration Constraints

Research Project 1 - [085851]

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**In this project a new optimal-control-based guidance law with a time-varying missile acceleration bound for ground-to-air missiles is derived. Saturation may cause a significant miss distance if it is not taken into consideration. A ground-to-air missile climes in altitude, and its acceleration limits vary as its altitude increases. The guidance law presented in this project explicitly incorporates a "hard" acceleration constraint, which gives it an advantage compared to other guidance laws, which usually have unbounded or softly constrained accelerations. The guidance law is derived for linear, first order, strictly proper missile dynamics and arbitrary order, linear target dynamics. The guidance law is derived for a linear quadratic optimal control problem with bounded controller. The proposed guidance law is evaluated in a nonlinear simulation and compared to the classical unbounded acceleration optimal control guidance law. The comparison shows a substantial advantage of the proposed guidance law when missile saturation is encountered. It is concluded that explicitly accounting for the missile's saturation limits substantially improves the missile's performance and its capability to intercept the target in challenging scenarios.**

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