This thesis proposes and evaluates a new cooperative guidance law called Cooperative General Vector Explicit Guidance. This cooperative guidance law is similar to a trajectory shaping guidance law called General Vector Explicit Guidance. General Vector Explicit Guidance simultaneously achieves design specifications on miss distance and final missile-target relative orientation in addition to providing a design parameter that adjusts the curvature (aggressiveness) of the flight trajectory. Motivated by the trajectory shaping design parameter and the potential lethality of final missile-target relative orientation provided by General Vector Explicit Guidance, Cooperative General Vector Explicit Guidance is an extension that allows a salvo of missiles to cooperatively achieve the same relative orientation specifications on a single target while providing a similar trajectory curvature design parameter.

Linear optimal control was used to develop Cooperative General Vector Explicit Guidance. The problem was formulated as a linear optimal output tracking problem which minimized a cooperative performance index subject to system dynamic constraints. The solution to the output tracking problem was of the form or a two point boundary problem that had to be solved forward in time from initial states and backwards in time from initial costates. The two point boundary problem was solved through the use a nonlinear differential Riccatti equation and a linear forcing equation. The nonlinear Riccatti equation was reduced to a linear Lypanov equation through the use of an auxiliary function. Then through linear systems theory the solution to the Riccatti equation and forcing function was obtained, yielding the Cooperative General Vector Explicit Guidance law.

The feasibility Cooperative General Vector Explicit Guidance was demonstrated across two scenarios: the ability to hit a stationary target and the ability to hit a moving target. Both scenarios were evaluated with two missiles participating in the salvo attack and with five missiles participating in the salvo attack. The results demonstrate the proposed Cooperative General Vector Explicit Guidance law was able to successfully guide a salvo of missiles to hit a stationary or a moving target with a specified final missile-target relative orientation.

Major: Electrical Engineering

Educational Career:
Bachelor's of Electrical Engineering, BS, 2012, University of Central Florida

Committee in Charge:
Zhihua Qu, Chair, Electrical and Computer Engineering
Aman Behal, University of Central Florida Professor
Yunjun Xu, MAE

Approved for distribution by Zhihua Qu, Committee Chair, on October 24, 2014.

The public is welcome to attend.