Multi-Vehicle Collision Avoidance via Reachability and Mixed Integer Programming

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***Abstract*—**

I. Introduction

- motivation – UAVs for civil purposes – difficult problem
- previous methods for dealing with multi-agent systems – references – limitations (especially with respect to HJ formulation) — linear/simple dynamics — non-cooperative settings — applications that don't directly address the problem
- HJ background – references – normal limitations
- HJ for multi-UAV systems – assumed structure (platooning, SPP)
- summary

II. Problem Formulation

Each vehicle

$$\begin{aligned} \dot{x}_i &= g_i(x_i, u_i) \\ i &= 1, \ldots, N \end{aligned} \tag{1}$$

Relative dynamics between i and j:

$$\begin{aligned} \dot{x}_{ij} &= f_{ij}(x_{ij}, u_i, d_i) \\ i, j &= 1, \ldots, N, i \neq j \end{aligned} \tag{2}$$

- Existence of solution

Target sets for each vehicle: $\mathcal{T}_i$. Each vehicle avoids $\mathcal{D}_{ij}$

III. Hamilton-Jacobi Reachability

IV. Mixed Integer Programming

V. Results

VI. Conclusions and Future Work

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