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Robust Nonlinear Control Theory with Applications to Aerospace Vehicles

AASERT Grant

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Progress Report
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1 Objectives

The objective of this research is to develop real-time algorithms for generation of feasible trajectories for mechanical systems that respect the input constraints (actuator magnitude and rate limits).

2 Status of Effort

This is an AASERT award that funds Mark Milam, a fourth year CDS student. The work to date has concentrated on methods for real-time generation of trajectories that extend traditional optimal control techniques to allow real-time operation. The current approach being studied is to begin with trajectories using a differentially flat approximation of the system, followed by a homotopy technique to transform the trajectory into a feasible, optimal trajectory that satisfies the constraints. Although the work shows some promise, there are difficulties in getting the code to run at real-time speeds and we plan to explore some additional approaches to overcome these limitations.

3 Accomplishments

The first six months of this effort were spent building up an experimental platform, the Caltech ducted fan, which will be used to test the algorithms that are being developed. This experiment provides an important testbed for real-time algorithms and is intended to represent the longitudinal dynamics of a high performance aircraft.

We have succeeded in putting into place a basic algorithm for computing feasible trajectories using a combination of differential flatness and homotopy techniques. These techniques show some promise, but getting them to run at the speeds required for real-time implementation remains an issue.

4 Personnel Supported

Mark Milam, Caltech graduate student (4th year).

5 Publications

None.