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Two Controller Designs of Hypersonic Flight Vehicle Under Actuator Dynamics and AOA Constraint

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Abstract

This paper studies the controller design for hypersonic flight vehicle (HFV) considering the actuator hysteresis and the angle of attack (AOA) constraint respectively. Firstly, the effect of input hysteresis dynamics are regarded as the combination of the partial loss of effectiveness (PLOE) and a bounded disturbance-like item, while the controller is modified by constructing adaptive compensation laws. Secondly, to ensure the constraint on AOA, a prescribed performance control (PPC) method is designed while the AOA tracking error is restricted by the pre-defined performance function. The two controllers are designed based on dynamic surface control, where a nonlinear adaptive filter is utilized to eliminate the bound layer error. The effectiveness of the designed controllers are demonstrated via the simulation results.

Index Terms – Hypersonic Flight Vehicle, Dynamic Surface Control, Adaptive Control, Input Hysteresis, AOA Constraint, Prescribed Performance Control

1 Introduction

With the capability of "prompt global strike", HFV has drawn the attention of many researchers, yet the control techniques of HFV still face many challenges due to its special characteristics including fast time-

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