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Finite-time Formation Control for Multiple Flight Vehicles with Accurate Linearization Model

Enjiao Zhao, Tao Chao, Songyan Wang*, Ming Yang

Control and Simulation Center, Harbin Institute of Technology, Harbin,150080, People's Republic of China

Abstract: The finite-time leader–follower formation control problem of Multiple Flight Vehicle (MFV) system with accurate linearization model is considered. Herein, there is only one leader, the interaction topology among the followers is undirected, and the followers are reachable from the leader. Precise feedback linearization based on differential geometry theory is used to linearize the nonlinear motion model of the flight vehicle and the system model with follower track errors is formulated. A distributed formation control protocol based on finite-time control theory is proposed. With the designed control law, the MFV systems can achieve the desired formation in finite time, where the formation configurations can be specified in advance according to the task requirements. Meanwhile, the convergence analysis is proved and the protocol performance is discussed. Finally, simulation results further demonstrate the effectiveness of the proposed method.

Keywords: Multiple flight vehicles; Formation control; Finite-time; Differential geometry theory

1. Introduction

During the past two decades, the cooperative control problem of multi-agent systems (MAS) has been considerably studied due to its broad applications, such as rescue missions [1] and monitoring tasks [2], spacecraft formation[3][4], etc. Such missions generally cannot be carried out by an individual vehicle even with advanced facilities, since it not only has restricted coverage, but also has a weak robustness performance. One significant problem arising from MAS is to develop the control laws that enable all the agents of MAS reach an expected configuration, which

* Corresponding author. Tel.: +86-451-86418807-8412(Lab); +86-13136760267(MP).
E-mail address: zhaoenjiao935@163.com