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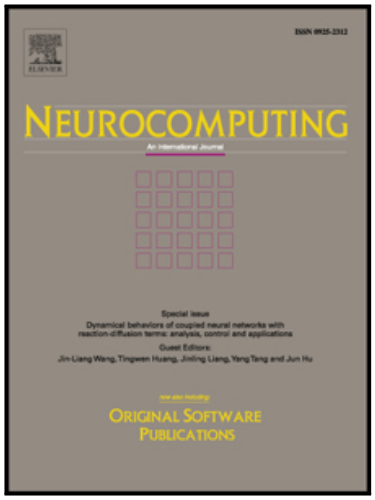

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Bearing-Based Formation Control of Networked Robotic Systems with Parametric Uncertainties

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Abstract

In this paper, the distributed bearing-based formation control problem for networked robotic systems with parametric uncertainties is investigated. Firstly, under the consideration that the task-space velocity is measurable, a reference control input is designed to achieve a bearing constrained target formation. For the unmeasurable task-space velocity case, an observer-based reference velocity scheme is proposed and only the local relative task-space position measurement is needed to achieve globally bearing-based formation stabilization. By designing a velocity feedback in proportional-integral reference velocity control scheme, at least two leaders can handle the leader-follower formation tracking problem, in which the followers do not need any global information. Finally, some simulation results are provided to demonstrate the effectiveness of the proposed control laws.

Keywords: Bearing-based formation control, networked robotic systems, bearing rigidity, adaptive control

1. Introduction

Cooperative control of autonomous robots has attracted extensive research attention in recent years due to its broad application in many areas. Formation control of networked robots has become one of the most important research topics in cooperative control field. In formation control, it requires robots to converge from random initial positions to a target formation with a pre-specified geometric shape. According to how the target formation is specified, the existing control approaches can be roughly categorized into three types: relative-position-based, distance-based and bearing-based [1]. For example, in [2, 3, 4], the authors considered the relative-position-based formation control problem in local coordinates. The distance-based formation control problem has been widely considered in [5, 6, 7] and the references therein. In the bearing-based formation control, the target formation pattern is specified by the inter-robot bearings. Comparing with the other two formation approaches, the bearing-based approach possessed some attractive features. Since the bearings are invariant during the formation *translation* and *scaling*, this approach provides a natural solution to translational and scaling formation maneuver control [8]. The bearing-based approach may also be used to solve the problem of network localization with bearing-only measurements [9].

Although the bearing-based formation control has made great progress recently, most of the existing works focus on the single-integrator or double-integrator robotic kinematic models [9, 10, 11, 12, 13, 14, 15]. In [16], the authors

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