

عنوان مقاله:

Hexagonal Formations in Leaderless Quadcopter Networks using RL and LQR Controller

محل انتشار:

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خلاصه مقاله:

This paper presents modeling, control, and multi-agent coordination techniques for networks of quadcopters. The ۱۲-state dynamic model captures rotational, positional, and velocity states governing quadcopter motion. For trajectory tracking control, LQR and reinforcement learning methodologies are explored. The LQR controller optimizes a quadratic cost function using Riccati equations to derive feedback gains. In reinforcement learning, Q-learning iteratively refines a control policy to maximize cumulative reward. For multi-agent control, a decentralized formation control law enables quadcopters to achieve desired hexagonal formations by aligning positions with neighbors while maintaining specified relative distances. The simulation case study demonstrates synchronized trajectory tracking and hexagonal formation establishment using both LQR and learning-based control. While both methods succeed in formation control, reinforcement learning generates superior, adaptive control signals. This research underscores the efficacy of LQR and learning for quadcopter control. The multi-agent coordination principles presented serve as integral building blocks for enabling versatile, intelligent drone formations across diverse application domains.

کلمات کلیدی:

quadcopter dynamics, LQR control, reinforcement learning, multi-agent systems, formation control

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