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FLOCKING IN MICRO-NANO SATELLITE INTELLIGENT CLUSTER SYSTEM WITH COLLABORATIVE AND AUTONOMIC CONTROL

Abstract

Micro-nano-satellite intelligent cluster is one of the hot spots in the research of space mission. For the characteristics of large number of satellites in cluster, complex network structure and uncertain space environment, we first established the relative dynamics model. Then, based on the efficient population topology optimization method, the optimal topology of the cluster is designed. According to the demand of changing configuration of cluster, using the method of graph theory and matrix analysis, the Laplacian matrix of cluster system communication is analyzed and the consistency conditions of second-order cluster system are obtained. Based on the second-order kinetic equation, we design a cluster flocking controller under the continuous time-varying topology. According to the conditions of successful tracking, a continuous differentiable Lyapunov function is established, which proves the stability and consistency of the system. Finally, the effectiveness of the method is verified by mathematical simulation.