Multi-Robot System Dynamics and Path Tracking

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Abstract

Leader detection and follow it are the main challenges in designing a leader-follower multi-robot system, in addition to the challenge of achieving the formation between the members while tracking the leader. The biological system is one of the main sources of inspiration for understanding and designing such multi-robot systems, especially, the aggregations that follow an external stimulus such as the population of Artemia. In this paper, a dynamic model of a multi-robot system following a spot of light, as a leader will design based on the collective motion behavior of the aggregations of Artemia. The kinematic model will derive based on observation of Artemia behavior under external stimuli, while the dynamic model will be derived based on the newton equation and its parameters will be evaluated by two methods: first one based on the physical structure of the mobile robot and the other based on Least Square Parameter Estimation method. Several experiments have been implemented in order to check the success of the proposed system, which are divided into four scenarios of simulation according to four trajectories, the straight line, circle, zigzag and compound path pattern. V-Rep software has been used for the simulation and results appeared the success of the proposed system and the high performance when robots are tracking the leader.

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