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FORMATION CONTROL OF A SWARM OF MOBILE MANIPULATORS

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ABSTRACT. This paper presents a new Lyapunov-based decentralized formation control planner for a swarm of 2-link mobile manipulators in an *a priori* known environment. To ensure a significant degree of formation stiffness along the flight-path, information on moving ghost targets, inter-robot bounds for aggregation and heading for the mobile manipulators are captured in the control planner. The final desired orientation of the formation is by observing a minimum distance between every member of the swarm and ghost walls. The nonlinear control laws extracted from the Lyapunov-based control scheme are utilized to obtain collision-free trajectories of the swarm in a low-degree formation, whilst ensuring stability of the kinodynamic system governing the swarm. The effectiveness of the controllers is demonstrated by simulating interesting situations.

1. Introduction. Social interactions in nature have inspired researchers to design numerous robotic systems that are capable of solving real-world problems for humans. One such biological behavior is swarming, a cooperative behavior seen, for example, in schools of fishes, flocks of birds, and herds of animals, to name but a few. This salient behavior is predominantly based on the principle that there is safety and strength in numbers [**5, 17**]. This swarm-intelligence system, if emulated appropriately, can satisfy stringent time, manpower and monetary demands, enhance performances and robustness, and harness desired multi-behaviors, each of which is extremely difficult if not entirely impossible to solicit from single agents [**6, 8, 16, 17**]. These multi-agent formations are tipped to play a very crucial role in the future. In fact, multi-robot formations are frequently sighted in places such as airports, factories, wharfs, and in farms and mines.

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