COOPERATIVE CONTROL USING PASSIVITY: FORMATION CONTROL AND ORIENTATION AGREEMENT

By

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ABSTRACT

We first study a formation control problem where the objective is to steer a group of agents to a formation that translates with a prescribed reference velocity. Unlike existing designs which assume that the reference velocity information is available to each agent, we consider the situation where this information is available only to a leader. We investigate the design flexibility of the passivity framework in [1] and develop an adaptive design with which the other agents reconstruct the reference velocity and recover the desired formation. This design relies only on relative distance information with respect to neighboring agents and, thus, can be implemented in a decentralized fashion. We further show that when introducing the relative velocity information is introduced, the adaptive design is capable to fully recover the reference velocity.

We then proceed to an orientation control problem where the objective is to achieve identical orientation and synchronous rotation for a group of rigid bodies. We exploit the inherent passivity properties in agent dynamics and quaternion kinematics and propose a passivity-based design which relies only on relative attitude information with respect to neighboring agents. This passivity-based design exhibits the similar structure to the framework in [1]. We also consider the situation where the reference angular velocity is available only to the leader, and propose a distributed adaptive controller with which the other agents reconstruct this reference velocity.