Title: Control-oriented learning for formation control of mechanical systems

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Abstract: Decentralized control strategies for multiple robotic systems have gained increased attention in the last decades in the control community. Distributed control algorithms for these systems present higher robustness and need of fewer resources per agent than centralized systems. Currently, researchers have shown an increased interest in employing distributed controllers, where the agents only rely on local information for executing their designated tasks. In particular, formation control algorithms have emerged as powerful tools for the usage of multi-agent systems.

Among the vast literature on decentralized formation control, two main approaches can be distinguished: position-based and distance-based formation control. In the first case, agents aim to converge to desired relative position vectors with respect to a subset of the rest of the team. Distance-based formation control focuses on stabilizing inter-agent distances, which allows controlling specific geometrical shapes described by the group of agents. Such formations are useful in cases where agents have no shared knowledge of global coordinates. Distance-based formation control of mechanical systems can be seen as a physical system of particles linked by springs, whose evolution can be described by a Lagrangian function.

Methods such as deep learning and reinforced learning have been successful in modeling and controlling many dynamical systems. For such methods to achieve a desired performance which appear in the real life, but we don’t know which dynamics follow, we often require multiple systems runs over large sum of data that sometimes may not be available in several scenarios. In this poster we present a method based on quadratic programming to approximate the Lagrangian associated with the distance-based formation problem from limited data from a single trajectory. We further show how to obtain bounds for the approximation errors.