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Bio-Inspired Coordination and Consensus of Multi-Agent Systems

Many biological systems, such as swarms of birds, flocks of beasts, schools of fish, armies of ants, and colonies of bees, exhibit fascinating collective behavior. It is observed that in such systems, each individual acts as an autonomous agent and interacts only with its nearby neighbors, while the entire group displays coordinated behavior and can accomplish very complex tasks. Inspired by such collective intelligence of animal groups in nature, there has been an increased research interests in multi-agent systems around the world in recent years. This talk discusses the distributed consensus problems of multi-agent systems with both fixed and switching topologies. Hybrid consensus protocols are proposed to take into consideration of continuous communications among agents and intermittent information exchanges on a sequence of discrete times. Based on the proposed algorithms, the multi-agent systems with the hybrid consensus protocols achieve consensus by employing results from matrix theory and algebraic graph theory. Our results show that the hybrid consensus protocols can solve the consensus problem if the union of continuous-time and discrete-time interaction digraphs contains a spanning tree frequently enough. Simulations are provided to demonstrate the effectiveness of the proposed consensus protocols.