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Static consensus of second-order multi-agent systems with impulsive algorithm and time-delays[☆]

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Abstract

This paper studies the consensus problem of second-order multi-agent systems with constant time-delay, fixed topology and impulsive algorithm based on periodic sampling. First, by theory of impulsive differential equations, it is proved that the consensus is achieved if and only if some matrix has a simple 1 eigenvalue and all the other eigenvalues are in the unit circle. Meanwhile, the consensus state of the system is obtained, which indicates that the positions and the velocities of all agents reach, respectively, a constant state and zero. Hence we say a static consensus is achieved for multiple second-order agents. Then, by stability of polynomials, we establish a necessary and sufficient condition from the perspective of topology and protocol parameters, which provides the range of allowable time-delay and the choice of impulse period. Finally, simulation examples are given to illustrate the effectiveness of the theoretical results.

Keywords: Consensus, Multi-agent systems, Impulsive algorithm, Time-delay, Second-order dynamics

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