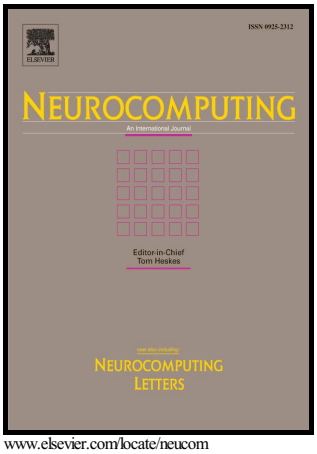
Static consensus of second-order multi-agent systems with impulsive algorithm and time-delays

Fangcui Jiang, Dongmei Xie, Bo Liu



www.elsevier.com/locate/neucom

PII: S0925-2312(16)31216-4
DOI: http://dx.doi.org/10.1016/j.neucom.2016.10.025
Reference: NEUCOM17637

To appear in: *Neurocomputing*

Received date: 31 August 2015
Revised date: 2 August 2016
Accepted date: 21 October 2016

Cite this article as: Fangcui Jiang, Dongmei Xie and Bo Liu, Static consensus o second-order multi-agent systems with impulsive algorithm and time-delays *Neurocomputing,* http://dx.doi.org/10.1016/j.neucom.2016.10.025

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

Fangcui Jiang[a,b], Dongmei Xie[c], Bo Liu[d]

[a]*School of Mathematics and Statistics, Shandong University, Weihai 264209, China*
[b]*School of Control Science and Engineering, Shandong University, Jinan 250061, China*
[c]*Department of Mathematics, Tianjin University, Tianjin, China*
[d]*College of Science, North China University of Technology, Beijing 100144, China*

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

☆This work was supported by National Natural Science Foundation of China (No. 61304163, No. 61473337 and No. 61304049), Natural Science Foundation of Shandong Province (No. ZR2013FQ008), Natural Science Foundation of Tianjin (No. 15JCYBJC19100), and Independent Innovation Foundation of Shandong University (No. 2013ZRQP006).

Email addresses: jiangfc@pku.edu.cn (Fangcui Jiang), dongmeixie@tju.edu.cn (Dongmei Xie), boliu@ncut.edu.cn (Bo Liu)