

# Accepted Manuscript

Distributed Cruise Control of High-Speed Trains

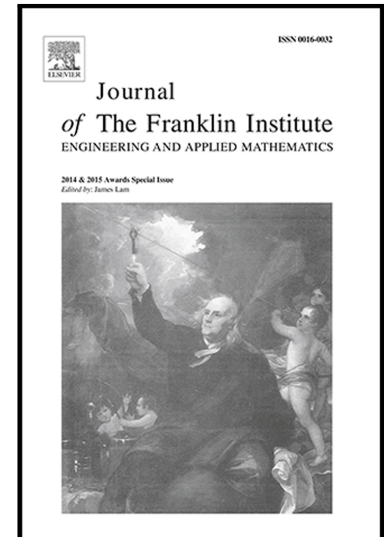
Yan Zhao, Tianzhi Wang, Hamid Reza Karimi

PII: S0016-0032(17)30318-6  
DOI: [10.1016/j.jfranklin.2017.07.004](https://doi.org/10.1016/j.jfranklin.2017.07.004)  
Reference: FI 3043

To appear in: *Journal of the Franklin Institute*

Received date: 21 February 2017  
Revised date: 30 May 2017  
Accepted date: 2 July 2017

Please cite this article as: Yan Zhao, Tianzhi Wang, Hamid Reza Karimi, Distributed Cruise Control of High-Speed Trains, *Journal of the Franklin Institute* (2017), doi: [10.1016/j.jfranklin.2017.07.004](https://doi.org/10.1016/j.jfranklin.2017.07.004)



This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Distributed Cruise Control of High-Speed Trains<sup>☆</sup>

Yan Zhao<sup>a,\*</sup>, Tianzhi Wang<sup>b</sup>, Hamid Reza Karimi<sup>c</sup>

<sup>a</sup>*School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798*

<sup>b</sup>*Advanced Control Systems Laboratory, Beijing Jiaotong University, Beijing, China 100044*

<sup>c</sup>*Department of Mechanical Engineering, Politecnico di Milano, 20156 Milan, Italy*

---

## Abstract

In this work, the cruise control problem of high-speed trains' movements is investigated. Both cases of a single high-speed train and multiple high-speed trains are under consideration. Different with most existing studies where the centralized control or the decentralized control methods are adopted based on a single point mass model of the train, in this paper, a distributed control mechanism is proposed by virtue of the graph theory, and the high-speed train's model is built as a cascade of point masses connected by flexible couplers. For a single high-speed train, the neighboring cars interact through the coupling force with each other, which can be described by a connected topological graph by regarding each car as a node. Besides, the speed information communication among the cars is considered to be described by another directed topological graph. A distributed control strategy is then developed, with which all the cars of a train track a desired speed asymptotically and the neighboring cars keep a safety distance from each other. For the multiple high-speed trains running on a railway line, the in-train force interaction topology and the speed information communication topology of all the trains are more complex than those of a single train. A new cluster consensus technique is developed, by which a distributed control law is designed. Under the control law, the trains can track the desired speeds asymptotically, the headway distance between ad-

---

<sup>☆</sup>This work is partially supported by National Natural Science Foundation of China under Grant 61573056, partially supported by the Fok Ying Tung Education Foundation under Grant 151065, and partially supported by the Foundation for the Author of the National Excellent Doctoral Dissertation of China under Grant 201449. Version dated July 12, 2017.

\*Corresponding author

*Email addresses:* zhaoresponsible@gmail.com (Yan Zhao), 14120215@bjtu.edu.cn (Tianzhi Wang), hamidreza.karimi@polimi.it (Hamid Reza Karimi)

Download English Version:

<https://daneshyari.com/en/article/4974091>

Download Persian Version:

<https://daneshyari.com/article/4974091>

[Daneshyari.com](https://daneshyari.com)