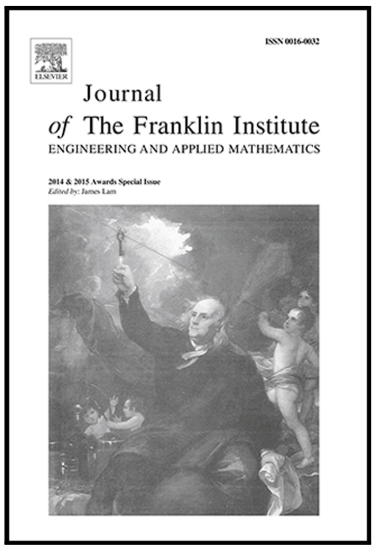

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Distributed Cruise Control of High-Speed Trains☆

Yan Zhao[a,*], Tianzhi Wang[b], Hamid Reza Karimi[c]

[a]*School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798*
[b]*Advanced Control Systems Laboratory, Beijing Jiaotong University, Beijing, China 100044*
[c]*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-

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*Corresponding author

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