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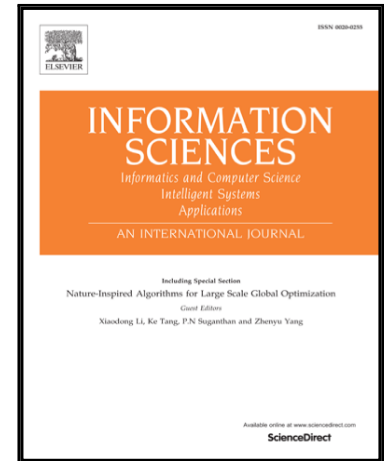
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Distributed networked control systems: A brief overview

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Abstract

Distributed networked control systems have attracted intense attention from both academia and industry due to the multidisciplinary nature among the areas of communication networks, computer science and control. With ever-increasing research trends in these areas, it is desirable to review recent advances and to identify methodologies for distributed networked control systems. This paper presents a brief overview of such systems regarding system configurations, challenging issues and methodologies. Firstly, networked control systems are introduced and their prevalent configurations including centralized, decentralized and distributed structures are outlined. Secondly, an emphasis is laid on a number of challenging issues from the analysis and synthesis of distributed networked control systems. More specifically, these challenging issues are identified through three integrated aspects: communication, computation and control. Thirdly, different methodologies in the literature for distributed networked control systems are reviewed and categorized based on three pairs: undirected and directed graphs, fixed and time-varying topologies, and time-triggered and event-triggered mechanisms. Finally, concluding remarks are drawn and some potential research directions are suggested.

Keywords: Distributed networked control system, communication network, communication constraint, network topology, time-triggered mechanism, event-triggered mechanism.

1. Introduction

The world is connected through networks. The most prominent example is probably the Internet which consists of a huge number of computers and users spread around the world. According to Wikipedia, the definition of the Internet is given as “a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide”. With the advent of networks, traditional point-to-point control systems are being reshaped and redefined, which gives birth to networked control systems (NCSs) wherein feedback control loops are closed via communication networks [85, 24, 29]. The defining feature of an NCS is that system components, such as sensors, controllers and actuators, are connected via some network medium, such as control area network (CAN), BACnet, Fieldbus, Ethernet and Internet. Therefore, information, such as reference inputs, system outputs or control inputs, is exchanged among system components via networks [24]. Compared with traditional point-to-point control systems, NCSs offer several ad-

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