2015-36-0400

A new clock synchronization algorithm to compensate the initial de-synchronization of clocks based on a deadbeat controller for networked control systems

Eloy Martins de Oliveira Junior
Marcelo Lopes de Oliveira e Souza
National Institute for Space Research – INPE – Brazil
Division of Space Mechanics and Control-DMC

Abstract

Aerospace, automotive and aeronautical control systems demand high performance, precision, accuracy, modularity, integration, dependability and other attributes. Currently, to supply these requirements, engineers are using Networked Control Systems (NCSs) with Time Division Multiple Access (TDMA) databuses. They are part of Distributed Time Based Architectures (DTBAs) that provide the infrastructure for the design and implementation of safety critical distributed systems. These architectures provide a common time basis among the nodes of a system. However, the benefits of this approach face the challenge of establishing a common time basis among the nodes of a distributed system since startup until shutdown. For this, clock synchronization algorithms are used to achieve a common time basis within some precision and/or accuracy among the nodes of a system. So, clock synchronization algorithms become a critical part of designing distributed systems. But most of them suppose the clocks initially synchronized, what is unrealistic. This paper presents a new clock synchronization algorithm to compensate the initial de-synchronization of clocks based on a deadbeat controller for networked control systems. To do that, it presents a review of the literature, the new algorithm, its discussion, modeling and simulation. The results show: 1) the features of the problem of initial de-synchronization of clocks in a NCS; 2) an evaluation of the new clock synchronization algorithm proposed based on a deadbeat controller; and 3) the improvements of the clock synchronization algorithm proposed over the NCS performance.