

Editorial

Cyber-Physical Systems: Computation, Communication, and Control

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The interest in the study of cyber-physical systems (CPSs) has grown exponentially over the last few years. CPS describes a class of complex systems that feature tight integration and coupling of their cyber and physical (natural and human-made) aspects. The main difference of CPS and smart or intelligent sensor networks lies in the introduction of control and interaction with the physical world to the computation and communication mix that came in a simpler form in sensor networks. Emerging applications include transportation, energy, health care, manufacturing, entertainment, consumer electronics, environment monitoring, and all of the essential infrastructure pieces supporting our modern life.

In this special issue, we focus on the most recent developments in the field of CPS, covering both theoretical subjects and industrial applications in CPS. Out of 18 submissions, 6 exceptional contributions have been selected after several rounds of review by international experts in respective areas.

In the paper “*An RTLS-based approach to cyber-physical systems integration in design and construction*,” A. Akanmul et al. present an approach to facilitate bidirectional coordination between physical construction components and their virtual models. Specialized real-time location sensing (RTLS) tags are used for tracking the position and status of physical construction components that are tightly bound to the associated building information model (BIM). This approach shows significant opportunities for enhancing real-time construction consistency checking which will aid proactive decision making and control.

The paper “*A novel reliability assurance method for cyber-physical system components substitution*” by P. Wang et al. considers the decision problem of services substitution

through a service-oriented architecture of CPS. A reliability assurance method is proposed by evaluating the relationship between service compatibility and substitution processes based on time-space π -calculus and service management theory.

The authentication of machine-to-machine (M2M) communications in wireless sensor network is formulated by W. Ren et al. in the paper “*How to authenticate a device? formal authentication models for M2M communications defending against ghost compromising attack*.” Attacking adversaries, corresponding adversaries, and concrete attacking methods and authentication approaches are presented to proof the authentication security. Furthermore, a uniform authentication framework is constructed for M2M context, and all possible authentication mechanisms are pointed out in M2M.

Efficient metadata management is a substantial new problem of large-scale distributed file system, and how to improve the performance and availability of the network file system is still a challenging issue. The paper “*An improvement of static subtree partitioning in metadata server cluster*” by Z. Tan et al. proposes a half-dynamic subtree strategy that supports the replication of metadata, the dynamic addition, and failure recovery of metadata server (MDS).

The last two papers are concerned with CPS computation and information fusion. The paper “*A traffic parameters extraction method using time-spatial image based on multi-cameras*” by J. Wang et al. proposes an approach for the extraction of traffic parameters in the highway based on time-spatial image and data fusion. Through network communication, traffic information picked up by each camera is transformed to the data fusion server to improve the accuracy

of traffic parameters extraction. In the paper “*Structural damage information fusion based on soft computing*” by H. He et al. an information fusion method is discussed for structural health monitoring and damage detection of large-scale sensor networks.

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