Introduction to the Special Section on Reliability, Safety, and Security of Railway Systems

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RSSRail is an International Conference on Reliability, Safety and Security of Railway Systems, which occurs every 18 months. During the pandemic, it was decided that a special journal collection of articles concerning formal approaches for railway safety and security would replace the physical event of RSSRail 2021. This special collection presents methods for efficient, formal development, and verification of railway signalling subsystems like points specified by the European EULYNX standard, speed controllers specified by ETCS, and interlocking systems. Furthermore, an original formal-based methodology using deep reinforcement learning is detailed.

This collection includes the following four papers:

(1) "A Case in Point: Verification and Testing of a EULYNX Interface by M. Bouwman" by D. van der Wal, B. Luttik, M. Stoelinga, and A. Rensink. A case study on the application of automated verification and testing techniques to railway subsystems, specified using the European EULYNX standard, is presented.
(2) "A Refinement-based Development of Cyber-physical Railway Signalling Systems" by Y. Aït-Ameur, S. Bogomolov, G. Dupont, A. Iliasov, A. Romanovsky, and P. Stankaitis. This article proposes a generic railway signalling system specified in Event-B. It extends previous work on the modelling of a train speed controller. The model is extensible by refining this generic model using Event-B refinement.

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(3) "Compositional Verification of Railway Interlocking Systems" by A. E. Haxthausen and A. Fantechi. The article presents a compositional verification method aimed at chopping the verification of a large interlocking system into that of smaller fragments able to be model-checked. The method is proved to be sound and complete.
(4) "A Deep Reinforcement Learning Framework with Formal Verification" by Z. Boudi, A. Ait Wakrime, M. Toub, and M. Haloua. Based on ontology transformation to B-machines, the article presents an approach to constructing a valid career agent with Deep Reinforcement Learning. The Agent policy is built on a framework using a decentralized training approach.

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