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THIRD PRIZE

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Category: **Rail**

Country: **Germany**

Research Area 8: **Planning, Modelling and System Design**

Idea Number: **38**

Reliability analysis of railway station infrastructure based on dynamic fault trees

Infrastructure availability is an essential prerequisite to providing passenger-friendly rail services with minimal delay. At the same time, investments are costly and have long-lasting effects on the operability of railway networks. Hence, detailed a-priori performance analysis is vital to ensure targeted and efficient use of resources. While formal methods have found widespread application in risk analysis and verification of software architectures or interlockings, their use in railway performance analysis remains limited. Even though recently established CENELEC standards call for standardization and formalization of RAMS management, quantitative assessment of infrastructure robustness and resiliency continues to rely on heuristics. Dynamic fault trees (DFT) and stochastic model checking can provide an important contribution to mitigating those shortcomings and providing decision support in infrastructure planning and asset management. In this project, a DFT-based reliability analysis tool has been developed that allows to investigate both the performance of the railway infrastructure as a whole and the criticality of individual components for system operability. As a result, comparative analysis of infrastructure layouts is made possible and focal infrastructure elements can be pinpointed. In a fully automated approach, the infrastructure is read from common exchange formats such as railML and train routes and their required elements are obtained by graph exploration. A fault-tree model is constructed on the train path level that builds on tracks and field elements such as switches, track circuits and signals as base elements. System performance is assessed based on the set of available train routes and performance metrics such as availability or mean-time-to-failure.

Key Characteristics

Railway performance analysis • RAMS management • Standardization • Dynamic fault trees

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