Abstract

Railway signaling is a critical component of modern transportation systems, ensuring the safe and efficient operation of trains. The correctness of railway signaling programs is of utmost importance to prevent accidents and ensure smooth train operations. This thesis explores the practical application of Linear Temporal Logic (LTL) in the verification of railway signaling programs, with a focus on real-world implementation and validation. We begin by providing an overview of the significance of railway signaling and the challenges associated with its verification. The limitations of traditional methods in ensuring the correctness of signaling programs are discussed, emphasizing the need for formal verification techniques such as LTL. The core of this thesis presents a detailed examination of how LTL can be employed for practical verification of railway signaling programs. Moreover, we discussed the development of verification tools and frameworks tailored to the railway signaling context. To validate the proposed approach, we present a series of case studies and experiments conducted on real-world railway signaling systems. These case studies illustrate the effectiveness of LTL-based verification in identifying and rectifying potential issues in signaling programs, route systems, train speed impacting on system and ultimately enhancing safety and reliability. .