

Formal Method and its Application on Train Operation Control System of Chinese high-speed Railway

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Abstract. With the development of the economic and society of China, a high speed transport method is urgently required to solve the travel problems of people. The train had been speeded up from 120 *km/h* to 250 *km/h* in the main line network. Chinese High Speed railway has been rapidly developed. Railway plays a more and more important role in the Chinese transportation systems. For the safety and efficiency of high speed railway, Chinese Train Control system (CTCS) is developed and some new technologies are researched.

CTCS Level3 is the train control system used in Chinese High speed railway. This system makes use of GSM-R to complete the safe communication between onboard subsystem and RBC subsystem, and employs the track circuit as a backup communicating approach to ensure the safety of the system. Now in China, CTCS Level3 system has already been used in four high speed railway lines, the total length reached 2076 *km*. And the line from Beijing to Shanghai will be put into operation next year, which also uses CTCS Level3.

To guarantee the safe operation of the train and improve the efficiency of railway traffic, we make use of many formal methods and propose some approaches of modeling, formal verification and developing of the CTCS Level3 train control system, including the Specification Validation and Verification, Hybrid system Modeling and Verification, model based test sequence generation approach and SCADE based safety critical system development method. The advantages of our method are: Establish a track chain among the system specification, model, model checking tools and verification results; generate test sequences automatically and generate safety code automatically.