

Behavioral fault modeling and analysis with SBIP: A Wheel Brake System Case Study^{*}

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Abstract. Behavior-Interaction-Priority(BIP) is a component-based framework for modeling complex systems. According to BIP framework, system can be represented by a set of components specifying the behavior which is synchronized and communicated by connectors that corresponds to subset of interactions. Behavioral fault modeling and analysis refers to an integration of model based system design and safety analysis. In this paper, we integrate fault-tree-based safety analysis into BIP model and using statistical model checking engine for the BIP framework(SBIP) to offer a stochastic information to components and the entire system. By using SBIP with statistic model checking, we verify system specification and calculate probability of fault issues. We also trace the simulation result to confirm the extended system model without fault keeps consistence of the nominal system model. We illustrate an airplane wheel brake system meeting the industry standards as case study to show its advantage in analyzing fault behavior of safety-critical systems in aerospace practice.

Keywords: Model Checking · Safety Analysis · Fault Tree · BIP.

1 Introduction

Giving introduction of BIP framework, BIP toolset, SBIP and, on the other hand, fault-tree-based safety analysis. Using structure of the paper as ending.

2 BIP framework

2.1 BIP

Giving BIP introduction, component definition, component semantics and interaction definition.

2.2 Stochastic extention for BIP

Giving SBIP introduction.

^{*} Supported by organization x.

3 Behavioral fault modeling

3.1 Fault-tree analysis

Giving introduction of fault tree and its semantics.

3.2 Fault-tree-based safety model in BIP

Giving approach of interating fault-tree and BIP model.

4 Aerospace case study

4.1 Overview of Wheel Brake System

Giving introduction of AIR6110 standards and Wheel Brake System, including fault tree and system architecture.

4.2 WBS system model aspect

Giving WBS system model aspect, including fault tree and norminal system model and fault model, table with modeling matrices and sample BIP code.

4.3 Formal verification and analysis in SBIP

Giving requirements and specification, using SBIP to do verification and analysis, comparing about norminal system model and fault model, results of formal verification including fault tree results with probability.

5 Conclusion

Giving conclusion.

6 Future work

Giving futurework.

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