

Binary Decision Diagram Based Methods to Evaluate the Reliability of Systems Considering Failure Dependencies

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Abstract : In many reliability and risk analysis, failures of components are supposed to be independent. However, in reality, the ignorance of failure dependencies among components may render the results of reliability and risk analysis incorrect. There are two principal ways to incorporate failure dependencies in system reliability and risk analysis: implicit and explicit methods. In the implicit method, failure dependencies can be modeled by joint probabilities, correlation values or conditional probabilities. In the explicit method, certain types of dependencies can be modeled in a fault tree as mutually independent basic events for specific component failures. In this paper, explicit and implicit methods based on BDD will be proposed to evaluate the reliability of systems considering failure dependencies. The obtained results prove the equivalence of the proposed implicit and explicit methods. It is found that the consideration of failure dependencies decreases the reliability of systems. This observation is intuitive, because more components fail due to failure dependencies. The consideration of failure dependencies helps designers to reduce the dependencies between components during the design phase to make the system more reliable.

Keywords : reliability assessment, risk assessment, failure dependencies, binary decision diagram

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