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Consideration of prior information generated by component tests in the reliability verification of a technical subsystem

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The development of a complex technical system can usually be described along a V-process (c.f., e.g., Forsberg and Mooz (1994)). It starts with the identification of the system requirements and allocates them top-down to subsystems and components. Verification activities start, where possible, on the component level and should be integrated bottom-up in the subsystem and system verification.

There are various challenges when summarizing the verification results over different hierarchy levels. On low levels, the set of testable failure mechanisms is in general incomplete as those depending on the system integration cannot be addressed thoroughly. Furthermore, test durations on different levels may be measured in different units such as load cycles, operating hours, mileage, etc. which makes aggregation difficult. In particular on lower levels, tests are often carried out decentrally, e.g. at component suppliers or testing service providers. To use these types of cascading reliability information adequately, results out of a preceding hierarchy level can serve as a prior information for the verification activity on the succeeding level.

In this talk we present a Bayesian method to overtake the result from component fatigue tests or simulation results as prior information in the consecutive subsystem verification for specific failure mechanisms. The method will be illustrated by an example of an automotive transmission system.

Literature

Forsberg, K. and H. Mooz (1994): The Relationship of System Engineering to the Project Cycle. National Council On Systems Engineering (NCOSE) and American Society for Engineering Management (ASEM). Center for Systems Management CSM P0003 RelSys 9508.

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