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Reliability Qualification Test Plan Derivation Method for Weibull Distributed Products

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Abstract : The reliability qualification test (RQT) is widely used in product development to qualify whether the product meets predetermined reliability requirements, which are mainly described in terms of reliability indices, for example, MTBF (Mean Time Between Failures). It is widely exercised in product development. In engineering practices, RQT plans are mandatorily referred to standards, such as MIL-STD-781 or GJB899A-2009. But these conventional RQT plans in standards are not preferred, as the test plans often require long test times or have high risks for both producer and consumer due to the fact that the methods in the standards only use the test data of the product itself. And the standards usually assume that the product is exponentially distributed, which is not suitable for a complex product other than electronics. So it is desirable to develop an RQT plan derivation method that safely shortens test time while keeping the two risks under control. To meet this end, for the product whose lifetime follows Weibull distribution, an RQT plan derivation method is developed. The merit of the method is that expert judgment is taken into account. This is implemented by applying the Bayesian method, which translates the expert judgment into prior information on product reliability. Then producer's risk and the consumer's risk are calculated accordingly. The procedures to derive RQT plans are also proposed in this paper. As extra information and expert judgment are added to the derivation, the derived test plans have the potential to shorten the required test time and have satisfactory low risks for both producer and consumer, compared with conventional test plans. A case study is provided to prove that when using expert judgment in deriving product test plans, the proposed method is capable of finding ideal test plans that not only reduce the two risks but also shorten the required test time as well.

Keywords : expert judgment, reliability qualification test, test plan derivation, producer's risk, consumer's risk
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