

# **Reliability Modeling and Optimization of New product Development Process**

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## **Abstract**

Several reliability engineering/management activities, including reliability prediction, modeling, and optimization, occur during a new product development (NPD) in order to growth the reliability of the product. It has been proven in the literature, that the reliability improvement should be considered as an essential part of an overall reliability activity in the early stages of developing a new product. The reliability growth planning (RGP) is critical in NPD since it provides the management with decision support in terms of the timing of a new product release, reliability performance monitoring and prediction, and budgeting product development cost.

Most of the existing RGP models in the literature emphasize the reliability growth modeling by utilizing the actual testing data; however, in the early NPD stage the actual testing data are rarely available for RGP model verification and validation. In addition, most existing RGP models consider a single product development stage by optimizing the single reliability maximization objective, which may not be able to well model the different reliability growth profiles over a product's multiple development stages. In addition, one of the most important processes in reliability growth program is design verification and validation (V&V) process. The product complexity, multiple failure modes, and various V&V options along with the demanding design objectives, call for a cost and time effective V&V activity plan which optimally covers all major product failure modes. From the reviewed literature, no effective and quantitative methodologies have been well explored for optimal planning of V&V activities.

In this research, a multi-objective multi-stage RGP is proposed which is able to model each stage's unique reliability growth profile due to different growth rates, new contents/technology, time and budget allocation for that specific stage. In addition to maximizing the reliability objective, minimizing the projected total reliability growth testing time, and minimizing the projected reliability testing cost are also considered. In addition, a general mathematical modeling and optimization approach is proposed to plan the verification and validation process which maximizes the reliability of the new product by implementing a set of V&V activities, which should cover different failure modes obtained from the design failure mode and effect analysis. It also considers the limited time and budget of NPD process, sequencing of V&V activities, and their effectiveness are also important factors.