CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 INTRODUCTION

In this work three major tasks are accomplished. First, software reliability prediction model is discussed; basic definitions of software reliability studies are recalled. Classification and relations of software reliability growth models are analysed. Application areas of software reliability concepts are investigated. Various parameter estimation methods are analysed.

As the second major task, software reliability model is selected, a new step of procedures with a parameter estimation system is proposed. In the final state of this work, a tool is developed to simulate both original and modified procedure to predict the reliability and observed the result via the proposed parameter estimation method.

6.2 DISCUSSION OF FINDINGS

This work has shown the accuracy of Gompertz software reliability model with alternative approach of parameter estimation. In particular, the test cases of each module have been taken along with number of defects. This work has proved that the proposed method is more appropriate for the testing team to make a decision about when to stop the process of testing.

We proposed a three parameter estimation method based on different types of data available using Least Mean Square (LMS) estimation. In general
the reliability at time ’t’ is estimated using two input values, they are; time interval and number of failures. The reliability estimation formula used in all the models is \( R = \exp(-\lambda t) \), where \( \lambda \) is number of failures with respect to time. In Gompertz model the reliability \( R \) is calculated using the above given formula, but in the real project testing phases, test cases are defined for each module and according to the test cases the testing processes are carried out. The testing result also based on number of test cases written for a particular module. Hence in our proposed work, while estimating the parameters for Gompertz model we have taken number of test cases as one of the parameter. So we have built a correlation between number of failures and number of test cases. More importantly this relationship can be used to obtain other model parameters that are needed to conduct software reliability prediction. We have proposed three parameter estimation methods, based on the collected data. This method is practiced on real time project and observed the reliability prediction accuracy. We have practiced this proposed parameter estimation method in web based applications.

In this work we have also done the goodness of fit of the model using our proposed method of LMS and observed that the result what we have predicted is much closed to the actual reliability.

It is observed that the ability of reliability prediction can be improved dramatically using our proposed approach. This is achieved primarily by modifying the existing parameter estimation method.

In this work we have taken the Gompertz reliability model (S- Shaped growth model), because recently discrete analogs of software reliability model has been used for many web applications. The model based on discrete analog of a Gompertz equation that has an exact solution has been used by researchers. The discrete equation that has an exact solution is easily applied to a regression equation to get parameter estimates and has advantages
compared to an ordinary difference equation. It yields accurate parameter estimates in the early testing phase. The use of Gompertz model for reliability growth is restricted to data with estimates or predictions of reliability values, at the onset of growth, which are less than 50%. From several data sets, it was seen that in general, reliability growth data with an S-shaped trend could not be described well by the conventional Gompertz model, because this model has a fixed value of reliability at its inflection points. Therefore, the parameter estimation approaches used in this model has modified in this proposed work. The resulting approach is much more flexible than its predecessor.

In general, the performance of SRMs strongly depends on the kind of data. For instance, even if the other SRM is best fitted to a data set, it may be the worst model for the other data set. Hence, when the software reliability is assessed with the SRM, one needs to select the representative models and to try them in parallel. In that sense, the Gompertz SRM with proposed approach of parameter estimation should be considered as one of the typical SRMs from the empirical conclusion as well as the theoretical view point. And also this proposed parameter estimation method could support other models like G-O model, Delayed S-shaped model etc.

The proposed parameter estimation method is applied on two parameter modes such as G-O model and Delayed S-Shaped model and compared the result with existing LMS parameter estimation method. The implementation is done on collected real time projects from heterogeneous group of companies by using dot Net. We observed that the modified approach of parameter estimation accurately predict the reliability of the software.

6.3 FUTURE WORK
The following are the enhancements that may be incorporated as a continuation of this research.

- Simulation of proposed system with other model can be experimented.

- This work has concentrated only on S-Shaped models, it could be extended to other categories like exponential model and Neural Network model with few modifications.

- Apart from this approach, a detailed project improvement may be a significant choice for the improvement of reliability of software products. For this purpose, it would be wise to start with classification and analysis of faults determined so as to find out the roots of the problematic points with development process and the development team. Once these points are determined, more specific solution may be proposed and supported with related projects.

6.4 SUMMARY

In chapter 1, a brief introduction about software reliability is given. Various software reliability models are analysed in detail.

Elaborate literature about the research work carried out in the area of software reliability model is given in chapter 2. The motivation and formal definition of the proposed work is given.

In chapter 3, the criteria for selecting software reliability models are analysed. Gompertz reliability model is elaborated.
In chapter 4, described various parameter estimation methods, a method is proposed to estimate the parameters of the Gompertz model by taking the number of test cases as the additional parameter.

In chapter 5, the proposed LMS parameter estimation method is implemented with the testing result taken from IT industries. The comparison study is done with the existing methods and with the G-O and S-Shaped reliability model. It is observed that the proposed method outperforms over other methods.

Conclusion and future enhancement is presented in chapter 6.