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Two Dimensional SRGMs for Debugging in Software Systems

Dr. M. Jahir Pasha [1] , Dr. K.K. Baseer[2], T. Satyendra Kumar [3]
[1] Associate Professor & HOD-Computer Science and Engineering department at
Dr. K V.Subba Reddy College of Engineering for Women, Kurnool
[2] Associate Professor in Information Technology department at
Sree Vidyanikethan Engineering College, Tirupathi
[3] Assistant professor in Computer Science and Engineeering department at
Sree venkateswara Engineering College, Tirupathi

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Abstract:
A prompt increase in the software industry has led to a great concern over its reliability. Major industries like health, transportation, banking, research etc. are based on large and complex software systems. This process has led to the development of many SRGMs by various researchers across the globe. They have been established in terms of uniform and non-uniform implementation purposes. Among these, some are flexible and remaining is not flexible. As there are different models to capture various situations, it gets difficult for the practitioners to pick and choose. To tackle this problem of late, few researchers have tried to implement a unique methodology to estimate various growth curves to choose the suitable model.

In this technique, we discuss the detail framework of random lag and hazard rate approach for SRGMs based on time and testing effort. We show a mathematical equivalence of the general solution for SRGMs which are dependent on testing effort by random lag approach and hazard rate approach.

Keywords*: SRGM, TEF, Hazard rate approach*

1. INTRODUCTION

SRGM is basic or initial technique that is developed to assess reliability of software quantitatively. The SRGM required to have contained a better performance by means of analysis, predictability and goodness of fit etc. To calculate and estimate any software reliability, failure occurred in data is need to be evaluated accurately by different techniques during the process developing software and operational stage

Software that is needed to be operating in a reliable way must still try or undergo a method of elaborative or rigorous testing and debugging process of forms. It may be a expensive one and a time taking process as well, that managers require perfect or precise details regarding how the reliability of software improves the range as the outcome of this particular event in order to sufficiently execute their related budgets and projects. Any projects can be made effective with this process by preparing software more reliable through the use of SRGM type of modeling, which is referred as SRGMs.

Many research attempts have been made in maintaining the reliability which is conducted

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from past three decades, also number of SRGMs have been proposed by the researchers so far. Personally, these models will provide the methods of indicating or featuring the development stage and it tries to enable the SR researchers to construct such assumptions regarding reliability level which is expected in future development of software conditions. This type of methods may allow maintenance people to exactly give the money, man power and time to develop successful product to evaluate and assess if the part of software has attain a point in which it will get release with few ranges of consistency in the reliability. These techniques frequently give inappropriate results due to some issues present.

2. PROPOSED METHODOLOGY

This proposed research work develops a SRGM model that facilitates technique for the use of TEFs (Testing Effort Functions) for SRGM based on NHPP which was discussed in the previous chapter. This technique, considers the process by which testing efforts behaves with respect to time and it in turn defined by Weibull-type TEF. In this research, the developed model has different phases. In the first phase, collections of fundamental assumptions which attributes for the model and presenting of SR and TEFs.

In second phase, the performance evaluation of the model which can be applied for the analysis trade-off with respect to the level for the reliability of the SRGM is carried out. The cost prediction, intensity of the models and reliability have been carried out on two real time fault databases. The results are encouraging and displaying fairly remarkable performances. In the proposed research a novel method of SRGM is developed with some additional assumptions in the system

- Faults in software or drawbacks are dividing into Type 1 and Type 2 with various severities. The testing effort is required that is depending upon the severity of detected failures in the system.
- The rate at which the faults are eliminated is time dependent particularly for its testing effort. The rate of change can be considered for analyzing or learning the increasing property with its time.

At the time of testing stage, the failure exposure rate is depends strongly with the skills of testing teams, program size and testability of the software. Hence, in this research, the failure removal [1] is considered as an important parameter to regulate the testing time and also effort required for the testing which is provided to a system. As mentioned above, the proposed method binds both the condition as time lag and nature of testing effort in its consideration.

It is observed that, at the time of testing, manpower and computer time was utilized as the resources requirement. The identification of the fault and excluding of bugs based on the general features and resources spent to recover the same. A time dependent character of TEF has been discussed in the literature. The Rayleigh and exponential curves were the two conditions applied to determine relationship among TEF consumption and time for testing which is given as calendar time.

When the resources were needed for the process, the exponential curve is applied to the testing are observed uniformly or acquired within particular time period or simply Rayleigh curve or else. In addition, the Logistic and Weibull parameters were also been applied to produce improvement in the testing effort. The SRGM along with testing effort is formulated with the help of a NHPP assumption in the system. Three ways of fault identification methods has been included and verified in this type of SRGM development having various database details.

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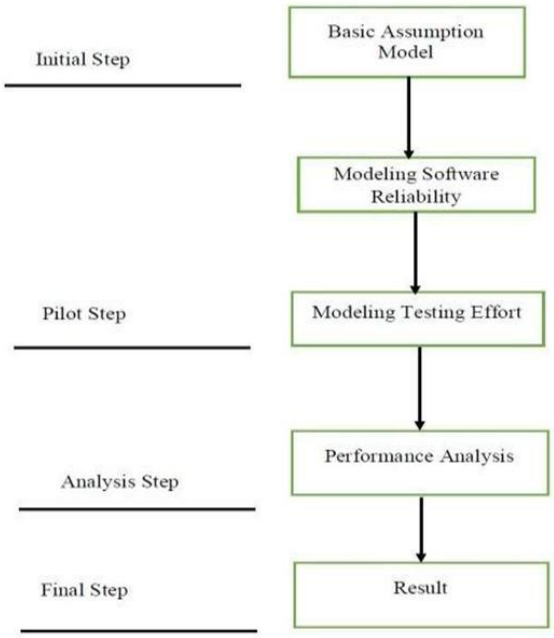

Figure 2.1 SRGM Flow Process

The SRGM describes about the time dependent characteristics of fault rejection. Various techniques of SRGMs and their features and also drawbacks were shown in the software reliability literature and testing strategy, but it is not sufficient to manage the reliability in software, yet more is to be established. The SRGM employed in this method accounts for many time dependent variation and developments for managing the TF (testing function) and its function. The efforts of testing are the resources involve in ruling the process of testing that can be applied for most of the software projects and it also includes,

- The personnel fault detection
- The personnel fault correction
- Computational time of the system

The important parameter of engaging human power for testing of software is to execute test items and compare the tested values with the ideal parameters. If deviation from the above mentioned parameters is simply considered as a drawback. The fault that is responsible for such failures are detected and removed by applying failure correction formulas and resolutions. Representation of the computer time is highly important and requirement so as to proceed with failure finding and as well as correction To explain the properties of testing effort, the functions such as exponential, logistic or Weibull, Rayleigh function is used in this method.

2.1 MODELING OF SRGM

The application of TEF (Test Effort Function) is added in some of SRGMs and their behavior is tested. The SRGM combined with testing employed in this manages the time lag between faults and its exclusion effort steps. The developed new method consists of the following assumptions explicitly;

- The observation of failure or the removal of fault technique is modelled by the modified NHPP.
- The software is defined to the faults accruing at the time of execution that are resulted by the remaining failures present in the system.
- If failure is noticed, then the immediate effort should be taken to compute reason of failure and this has can be removed.
- Delay of time exists in between failure notice and exclusion factor is assumed to denote the faults of urgency. When the severity of fault is more, then the time delay will also get increased.
- At the time of fault isolation or exclusion, no single new failure should be allowed inside.
- The exclusion rate of faults presents a logistic learning parameter because it is aimed as the learning steps will get increased as the time increases.
- Failure rate found in any software is affected equally by the faults remains available remaining in the system
- Fault isolation or removal and its rate to the ratio of intensity in TF is equivalent to gained faults numbers that consists of some causes to be noted.
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3. RESULTS AND DISCUSSION

In this work, two types of techniques to unify a wide range of SRGMs dependent upon testing effort under the general modeling architecture have been discussed. In this method, an SRGM method based on NHPP has been proposed along with the general brief discussion of SRGM and its types. The general approaches are discussed that derives more common concepts with simple assumptions, variables and constants with the basic SRG modeling with respect to NHPP.

The developed models, also provides a broader and theoretical framework which help to connect the knowledge of the researchers with the people, simply the interaction among software reliability metrics for various dimensions which are already given. The NHPP-SRGM shows a flexible nature towards both exponential value and demonstrations clearly in this research. This model also modified in several ways to get the impact of imperfect debugging strategy, fault/error prediction and also used to decide many important management decisions based on few problems such as release time, access time etc.

Table. 1 Performance comparison of the proposed system.

Fitness Criteria	SSE	MSE	Adj. MSE	RMSE
Data Set 1	0.06465559581	0.00047193865	0.04763	0.021724149
Data Set 2	0.00285100864	5.1836520728	1.47923	0.007199758
Data Set 3	0.00040120432	5.42168	3.347982	0.0023284501
Data Set 4	0.11832246717	3.19790451819	1.49365	5.6550017844
Data Set 5	0.70087600446	0.01797117960	0.67354	0.1340566283
Yamada et al. [4]	0.10920	0.5693	0.2822	0.09539
Ohba et al. [5]	0.34290	0.8517	0.8401	0.18330

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The following graphs demonstrate the failure intensity with respect to the testing for different values of time.

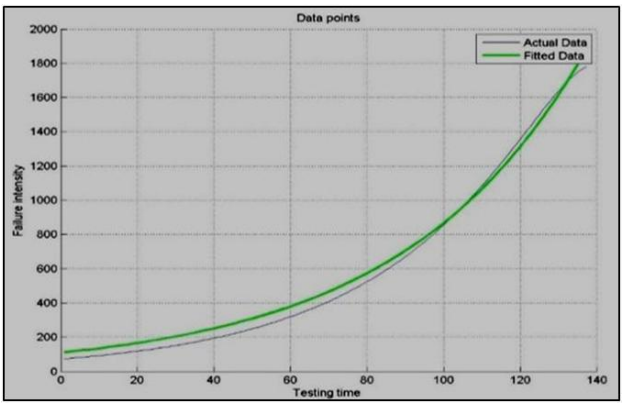

Fig. 3.1. Failure intensity characteristics for T1.

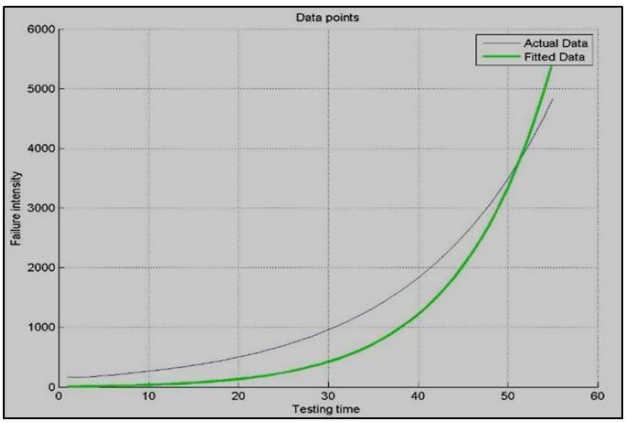

Fig. 3.2 Failure intensity characteristics for T2.

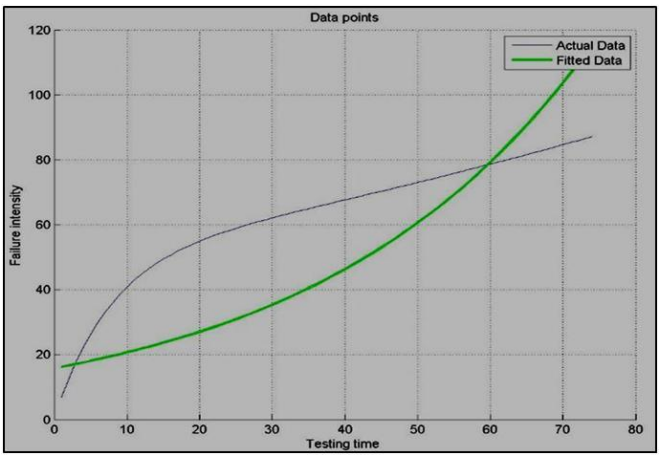

Fig. 3.3 Failure intensity characteristics for T3.

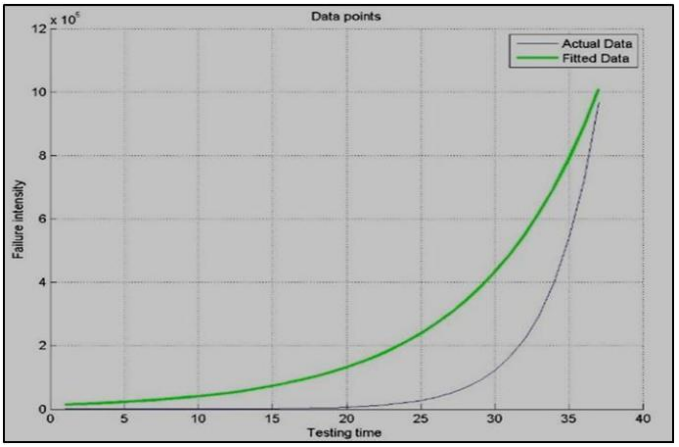

Fig. 3.4 Intensity of failure characteristics of T4.

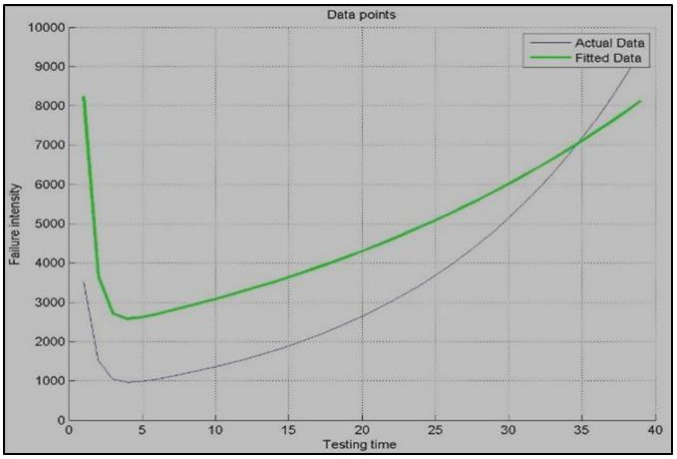

Fig. 3.5 Failure intensity characteristics for T5.

4.CONCLUSION

The proposed work is at last concluded by predicting that proposed NHPP-SRGM and fault or error count and generation model has better relative performance when compared to other SRGM techniques in the literature and it gives a reasonable capability of value for actual software failure data. Therefore, this model, in future, can be applied to operate a wide range of software and its applications.

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