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REVIEW ARTICLE ON RPGT - A GENERAL APPROACH

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Abstract:
In this paper, reliability model for availability analysis is discussed for steady state. The industry is divided into subsystem. Subsystems are either in series or in parallel. The subsystem may fail completely through partial failure. When any subsystem fails then the system is in failed state. The distribution of failure times and repair times are exponential and general. The system is in downstate if any of the fail completely. In this poster, expression for failure, availability, expected number of visitors and busy period of the server are derived under steady state condition using RPGT.

Keywords: *RPGT; Reliability Model; Availability Analysis.*

1. Introduction

1.1. Notations

$\left(i \xrightarrow{s_r} j \right)$: *r*-th directed simple path from *i*-state to j-state; r takes positive integral valuesfor different paths from *i*-state toj-state.

$\left(\xi \xrightarrow{sff} i \right)$: A directed simple failure free pathfrom ξ -state to i-state.

$V_{m,m}$: Probability factor of the state m reachable from the terminal state m of them-cycle.

$R_i(t)$:Reliability of the system at the time t, given that the system enter un failed regenerative state 'i' at t=0.

$A_i(t)$: Probability of the system in up time at time t, given that the system entered regenerative state 'i' at t=0.

$B_i(t)$: Reliability that the server is busy for doing a particular job at time t given that the system enter regenerative state 'i' at t=0.

$V_i(t)$: The expected number of server visits for doing a job in (0, t] given that the system enetered regenerative state 'i' at t=0.

λ_i : Constant failure rate of system.

w_i: constant repair rate of units.

Transition Diagrams of the system

State	Symbol
Up-state	O
Failed state	☐
Reduced state	⬭
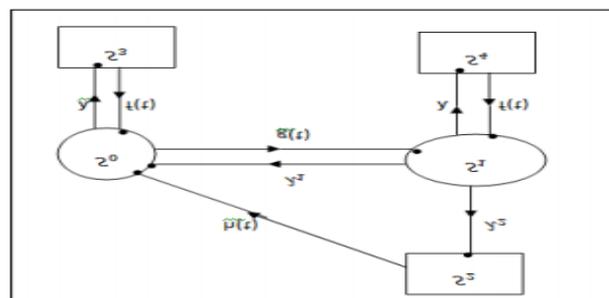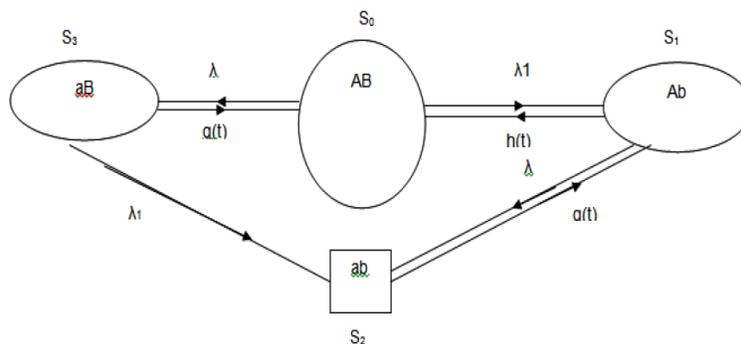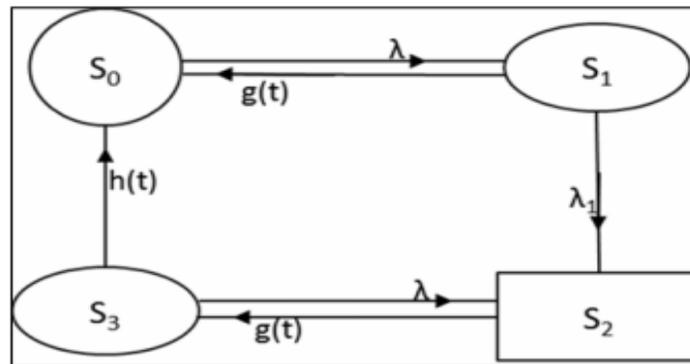
2. Formula Used for Calculations

Mean Time To System Failure (T_o):

$$\text{MTSF} = \left[\sum_{i,s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r(sff)} i\right)\right\}\cdot\mu_i}{\Pi_{k_1\neq\xi}\left\{1-V_{\overline{k_1,k_1}}\right\}}\right\}\right] \div \left[1-\sum_{s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r(sff)}\xi\right)\right\}}{\Pi_{k_2\neq\xi}\left\{1-V_{\overline{k_2,k_2}}\right\}}\right\}\right]$$

Availability of the System (A_o):

$$A_0 = \left[\sum_{j,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}j)\}f_j\cdot\mu_j}{\Pi_{k_1\neq\xi}\{1-V_{k_1,k_1}\}}\right\}\right] \div \left[\sum_{i,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}i)\}\cdot\mu_i^1}{\Pi_{k_2\neq\xi}\{1-V_{k_2,k_2}\}}\right\}\right] = \left[\sum_j V_{\xi,j}\cdot f_j\cdot\mu_j\right] \div \left[\sum_i V_{\xi,i}\cdot\mu_i^1\right]$$

Busy Period of the Server (B_o)

$$B_0 = \left[\sum_{j,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}j)\}\eta_j}{\Pi_{k_1\neq\xi}\{1-V_{k_1,k_1}\}}\right\}\right] \div \left[\sum_{i,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}i)\}\cdot\mu_i^1}{\Pi_{k_2\neq\xi}\{1-V_{k_2,k_2}\}}\right\}\right] = \left[\sum_j V_{\xi,j}\cdot\eta_j\right] \div \left[\sum_i V_{\xi,i}\cdot\mu_i^1\right]$$

Expected Number of Server's Visits (V_o):

$$V_0 = \left[\sum_{j,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}j)\}}{\Pi_{k_1\neq\xi}\{1-V_{k_1,k_1}\}}\right\}\right] \div \left[\sum_{i,s_r}\left\{\frac{\{pr(\xi\xrightarrow{s_r}i)\}\cdot\mu_i^1}{\Pi_{k_2\neq\xi}\{1-V_{k_2,k_2}\}}\right\}\right] = \left[\sum_j V_{\xi,j}\right] \div \left[\sum_i V_{\xi,i}\cdot\mu_i^1\right]$$

3. Expected Graphs
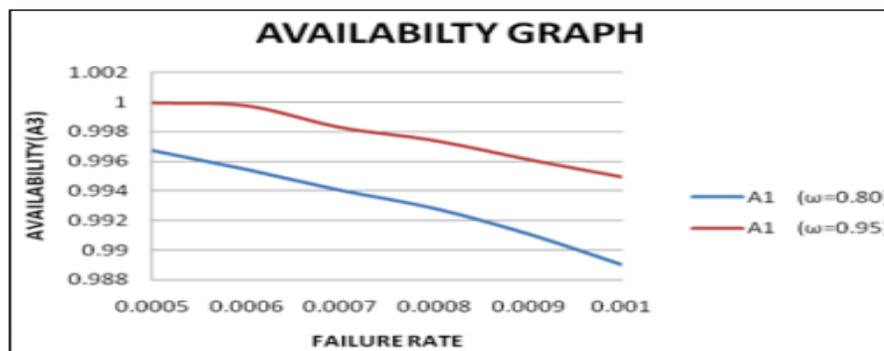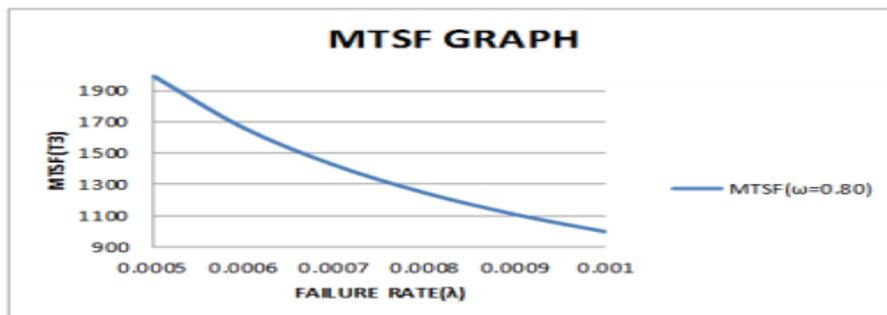
4. Conclusion

From graph, it follows that increase in the repair rate increases the availability of the system and the mean time to system failure whereas increase in the failure rate decreases the availability and the mean time to system failure which should be so practically. The RPGT is very useful for the evaluation of parameter in a simple way, without writing any state equation and without doing any lengthy and cumbersome calculations. It is easy for the management to control repair rate in comparison to failure rate.

References

[1] Chander S, Bansal RK. Profit analysis of a single- unit Reliability models with repair at different failure modes; Proc. Of International Conference on Reliability and Safety Engineering, 2005, 577-588.
[2] Gupta, V. K. Singh & Vanita (2010), 'The new concept of Base State in the Reliability Analysis'. Journal of Mathematics and System Science (IMASS), Vol. 6, No. 2.
[3] Kumar, J. Kadyan, M. S., Malik, S. C. & Jindal, C. (2014): Reliability Measures of a Single Unit System Under Preventive Maintenance and Degradation With Arbitrary Distributions of Random Variables, Journals of Reliability and Statistical Studies: ISSN 0974-8024, Vol. 7, p 77 – 88.
[4] Chander S, Bansal RK. Profit analysis of a single-unit Reliability models with repair at different failure modes; Proc. of International Conference on Reliability and Safety Engineering, 2005, 577-588.

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