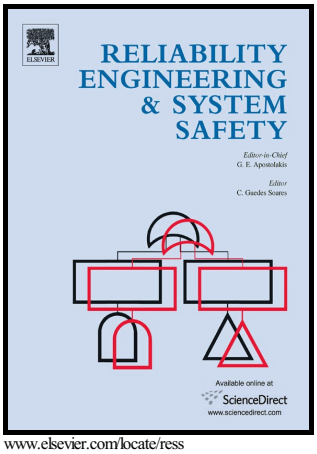

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PII: S0951-8320(16)30888-2
DOI: http://dx.doi.org/10.1016/j.ress.2016.11.025
Reference: RESS5707

To appear in: *Reliability Engineering and System Safety*

Received date: 30 April 2016
Revised date: 23 September 2016
Accepted date: 27 November 2016

Cite this article as: He Yi and Lirong Cui, Distribution and Availability for Aggregated Second-Order Semi-Markov Ternary System with Working Time Omission, *Reliability Engineering and System Safety*, http://dx.doi.org/10.1016/j.ress.2016.11.025

Distribution and Availability for Aggregated Second-Order Semi-Markov Ternary System with Working Time Omission

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Abstract: Discrete repairable degradation systems can be modeled by a homogeneous discrete-time second-order semi-Markov chain with finite state space for theoretical and practical sake. In the present paper, the state space can be divided into three subclasses, namely excellent states, good states (middle states) and failure states. The transitions among states may be driven by degradations and inside shocks of the system, repair actions, self-healings, energy supplement and other recovery ways. The Z-transform is used to give distributions for some interesting problems such as distributions of an I-period (oscillation & working time) and a gap between I-periods, and instantaneous and steady availabilities of the system. Finally, some numerical examples are given to illustrate the results obtained in the paper. The work may be used in reliability and maintenance analysis of discrete time repairable systems.

Keywords Second-order semi-Markov, multi-state system, discrete repairable degradation system, time omission, distribution and availability

Notation：

$Q_{ik,hj}(n)$ Elements in the $(i\times k_\Omega + k)$ th row and $(h\times k_\Omega + j)$ th column of semi-Markov kernel $\boldsymbol{Q}(n)$ of a system.

$\boldsymbol{Q}_{XY,YZ}(n)$ Sub-matrixes of $\boldsymbol{Q}(n)$ whose element $Q_{ik,hj}(n)$ satisfies $i \in X, k, h \in Y$, $j \in Z$ and $X, Y, Z \in \{\mathsf{A}, \mathsf{B}, \mathsf{D}\}$.

Ω State space of a second-order semi-Markov ternary system.

$\mathsf{A}, \mathsf{B}, \mathsf{D}$ Subsets of Ω and $\Omega = \mathsf{A} \cup \mathsf{B} \cup \mathsf{D}$.

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