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Transient Analysis of Two Type Data System Using Renewable and Emerging Technologies

[a]Pirah-Khan-Pathan, [b]Dr. Waijah Shah
Electronics Engineering Department, MUET Jamshoro
Email address for corresponding author: khanpirah@gmail.com

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Abstract ***This paper presents the transient analysis of a two-type data system is designed through finite queuing method with inner threshold (limit) for better performance stable analysis.. This system reduces congestion in the system by varying rate of data. The outcome of the system shows that the effects of fluctuation totally relay on the difference between two inner threshold standards.***

Index Terms—**Hysteresis, Markov Chain, Threshold, Transient.**

I. INTRODUCTION

THE queuing theory is the most useful way to analyze the transient behavior of system having two types of data. The system with boundaries and controlled arrival rate can be evaluated through queuing theory for their transient analysis. There be numerous module of queuing systems during which a transient analysis is requisite essentially in transient model analysis effect of minute signal because steady-state outcomes totally relay on running the system long enough to negate the change of minute signal. In simple words queue is normally define as consisting of an attendant and a waiting line for client need service from the server. New client will join the queue at the end of the waiting line. As the client at the obverse of the line are served those behind rapidly move at the head of line. A clientleaves as soon as they receive service require from the server and the server begins to serve the next customer in line.

In queuing theory a model is constructed so that queue lengths and waiting time can be predicted. The system is modeled in queuing model by assigning arrivals and service rate to show the system parameters the simple queue system is shown a figure: 1 entire system behavior simply shows in graphical representation of each and every system in Markov Chain.

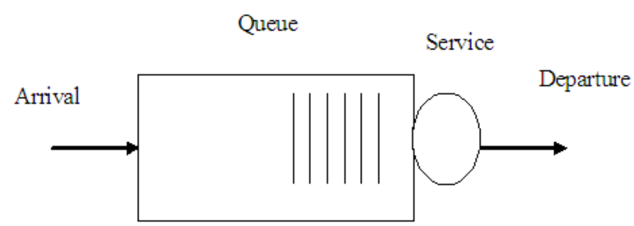


Figure: 1The simple queuing system

1. *MODELS AND INTERPRETATIONS*

Authors generates hysteresis Queuing model with the help of Matrix Geometrics Method so first of all we describe Markovian Distribution.

a. *Markovian Distribution:*

The simplest of these processes is a Poisson procedure wherever the time between every arrival is exponentially distributed depends on states present and not precedent state. It has memory less assets.

b. *MG Method:*

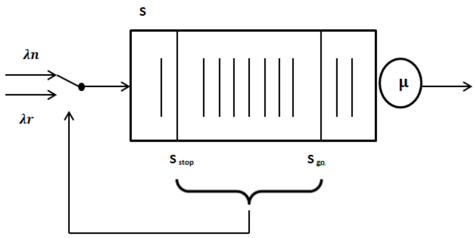
(MGM) is the simple the system in transient mode. This system consists of different numeral of stepladder to resolve ordered Markov chain.
These stepladders are:

1. Build up a queuing model for system.
2. Create a Markov chain.
3. Using Matrix Geometric Method.
4. Obtaining analytical equation.
5. Evaluate the equations.
6. Obtaining performance measures.

c. **Model of Hysteresis Queuing**

Hysteresis queuing mold among two internal thresholds with the Markoviar allocation be presented in to Figure: 2 the structure treats ultimate ability of clients with queue ability S.

Clients appear at the structure among two diverse rates of arrival followed by Markovian distribution. These arrival rates are divided and listed as normal λn and minimized up to λr rates.

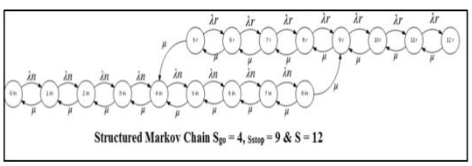


(2)

Model of Hysteresis queuing system (internal thresholds & Markovian distribution)

2. MG MODEL OF HYSTERESIS QUEUING ALONG

Hysteresis queuing model represented as shown in figure 3 below.



(3)

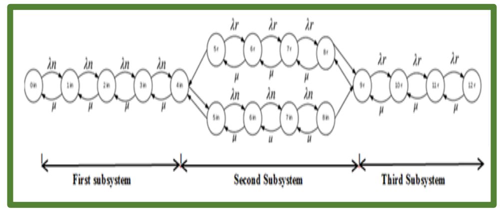
In equation (1) the intestinal GM of the Markov chain is defined:

$$\begin{pmatrix}
-\lambda & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & \lambda r & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & -\mu
\end{pmatrix} \quad (1)$$

Where $\alpha = -(\lambda n + \mu) b = -(\lambda r + \mu)$.

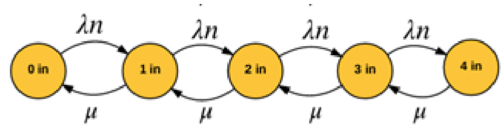
By solving the structured model, we will generate three sub systems according to the customers' arrival as shown in figure 4.

Structured Model Chian of Markov



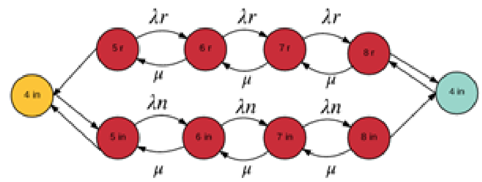
(4)

In Fig. 5, 1st system model of MC is considered as an idle threshold S_{go}, where only predefine ordinary arrival rate λn is defined in Fig: 5.



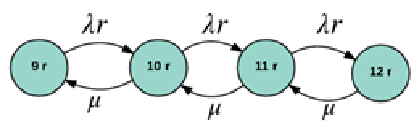
(5)

In The second subsystem structured Markov chain is consider in 2nd internal of thresholds S_{go} and S_{stop}, in which clients can be permitted all rates (λn,λr) and can be defined in Fig 6.



(6)

In predefine figure the last subsystem is followed 2nd threshold S_{stop} to reduce the queue capacity S, in which clients will be given permission till normalizing or reducing the arrival rateλras shown in figure: 7.



(7)

Afterwards solving the structured model we have generated three sub systems know we are going to generate equation of these three sub systems with the help of intestinal MGhave into the boundary conditions and can be repeated the states of each model and further can be defined as in Eq. (2)

$$\begin{pmatrix}
-\lambda & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & \lambda r & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & -\mu
\end{pmatrix} \quad (2)$$

From Equation (3),

- A_0, A_1, A_2 are sub-matrices of repeating edge.
- B_0, B_1, B_2 are initial boundary of sub-matrices. and
- B_3 is the final boundary of sub-matrix.

$$Bo = [-\lambda n], B1 = Ao = -[\lambda n], A1 = [-(\lambda n + \mu)], B2 = A2 = [\mu] \ldots 3$$

And other system structured Markov chain of sub-matrices as shown in Equation (4).

$$B3 = [-\lambda n + \mu], B4 = -[\lambda no], B2 = \begin{pmatrix} \mu \\ \mu \end{pmatrix}, \overline{A1} = \begin{pmatrix} -\lambda n + \mu & 0 \\ 0 & (-\lambda r + \mu) \end{pmatrix} \overline{Ao} = \begin{pmatrix} \lambda n & 0 \\ 0 & \lambda r \end{pmatrix}, \overline{A2} = \begin{pmatrix} \mu & 0 \\ 0 & \mu \end{pmatrix} \ldots 4$$

From equation 4 its clearly illustrated that the initial and final boundary of the sub-matrices are B_3, B_4, B_5 and B_6. Where $\overline{Ao}, \overline{A1}$ and $\overline{A2}$ are sub-matrices of repeating edge of the system.

In equation 5 sub matrix of third sub system is shown in repeating boundary.

$$B6 = \begin{pmatrix} (-\lambda n + \mu) & 0 \\ 0 & (-\lambda r + \mu) \end{pmatrix}, B7 = \begin{pmatrix} \lambda n \\ \lambda r \end{pmatrix}, B8 = \begin{pmatrix} 0 & \mu \end{pmatrix}, \overline{A1} = [-\lambda r + \mu], \overline{Ao} = (\lambda r), \overline{A1} = (\mu) \ldots 5$$

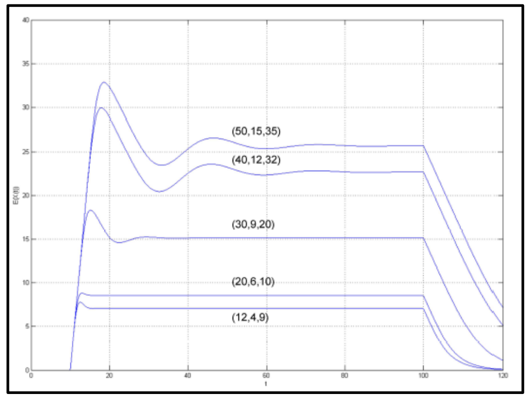
It's shown in equation 5 that repeating and boundary edge of sub-matrices are $\overline{Ao}$, $\overline{A1}$, $\overline{A2}$, B_6, B_7, B_8 and B_9. By putting these sub matrices equations in the intestinal generator matrix then Equation 6 is generated from equation 6 finitesimal generator matrix becomes block finitesimal generator.

$$\begin{pmatrix}
-\lambda & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \mu & a & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & 0 & \lambda r & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & a & 0 & \lambda n & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & 0 & b & \lambda r & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & b & \lambda r \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \mu & -\mu
\end{pmatrix} \quad (6)$$

The resultant of equation 6 finitesigmal generator matrix in block structure is same as the result of finite Qassi Birth Death process.

3. ANALYTICAL RESULTS:

The transient Analysis of the hysteresis model can be shown in figure: 8 for different size of the system. S_{go} and S_{Stop} thresholds.



(8)

From Figure: 8 the result is clearly illustrated that the mean number of the system is λn=6, λr=0.1, μ=1.

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4. CONCLUSION

In this paper, we have utilized Matrix Geometric Method in vector domain of Runge-Kutta (RK) to resolve the transient behavior of two type of data queue system. MGM utilizes the special features of MC to get the sub matrices through RK methods.

A continuous time queuing analysis can be used to compare with MGM and Runge-Kutta procedure to evaluate the controlled arrival rate hysteresis queuing. The results shows little fluctuations in means number by varying the internal thresholds & capacity of queue in a transient structure. Finally, authors described that Runge-Kutta Vector efficient way to analyze the transients of any systems.

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