Model of serial production line

Student Thesis

submitted by

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Eidesstattliche Erklärung

Ich erkläre, dass ich die vorliegende wissenschaftliche Arbeit selbständig, sowie ohne unerlaubte fremde Hilfe verfasst und nicht anderweitig für Prüfungszwecke vorgelegt habe. Alle verwendeten Quellen und Hilfsmittel wurden angegeben, sowie wörtliche und sinngemäße Zitate als solche gekennzeichnet.

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Abstract

In the last few years, the research of redundant robots and bi-manual arm manipulator systems has experienced rapid progress among the robotic community.

contents

Keywords: Keywords, Geomatric Machine, Production Lines

Contents

List of Figures

List of Tables

1 Introduction

Production system has been studied widely during the last 65 years [1]. A production system is an industrial system that describe a procedure to transform from different resources into useful products. In this process, producing units (human operators, industrial robots, cells, etc.) and resource handling devices (shelves, carts, holders, vehicles, etc.) connected with each others so that desired products can be produced. It is a very important part of manufacturing research and application.

Extensive research has been invested in develpoing for design, modeling, improvement, analysis and control of production systems (for instance, monographs [2–5]). Despite the fact that in practice production systems may take several kinds of physical topologies, serial lines and assembly systems are the two most basic structures used in different manufacturing environments. In the literature, however, while serial production lines have been extensively investigated, assembly systems are paid much less attention. Early research equipment systems only considered the case of multi-sequence single servers, where different types of parts arrived but the servers were assembled together. Inspired by these works, a three-server system with limited sequence capacity was studied. In these papers, dual servers represent component part production, and other servers represent assembly operations.

The steady state behavior of production systems has been deeply studied in the last few years. Although it is often difficult to declare from the partial view that a production system is in steady state, the steady-state analysis approach is effective and accurate enough for manufacturing systems with large production capacity. The large production capacity allows the system to decay instantaneously to a negligible time compared to the global production run-time, and, therefore, allows it to use steady-state methods. Unfortunately, in addition to large-capacity manufacturing, there are a large number of mid- and small-capacity manufacturing systems in practice, which usually operate in a different method. In some these cases, one production line is usually able to produce several end products but can only produce one type of end product, equipment or special product at a time because of process. This usually lead to small- to medium-size production run-based operation based on the customer's order, where a production run contains only a specific amount of particular type of product. Obviously, when the size of the production run is relatively small, the steady-state approaches cannot provide an ideal and accurate analysis of system. In some industries, a production run somtimes means a batch.

Nevertheless, the transient period of the behavior in production system has received much less research attention because of its complexity and the still large numbers of unsolved problems in steady state production systems research. On the other hand, recent research [6] has proved that transient analysis has become one of the most important fields in production systems research.

2 Analysis of the Paper

2.1 one machine model

the Figure 2.1 is a model of geometric machine

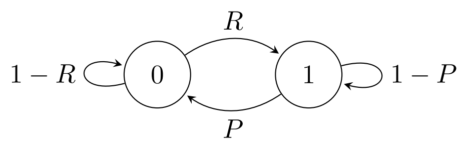


Figure 2.1: State transition diagram of one geometric machine

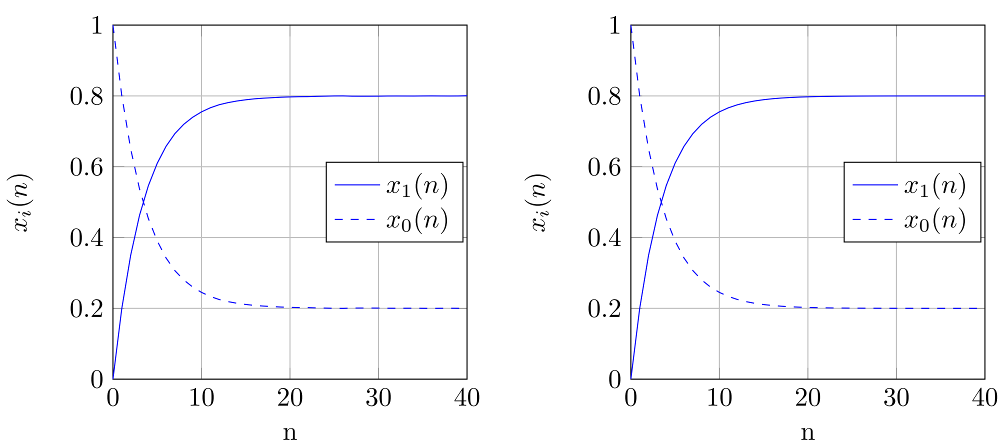
the production rate and consumption rate of an individual machine with the original state of down(0) can be calculated as

$$PR(n) = CR(n) = x_1(n) = \begin{bmatrix} 0 & 1 \end{bmatrix} x(n) = \begin{bmatrix} 0 & 1 \end{bmatrix} A_1^n x(0)$$

where

$$A_1 = \begin{bmatrix} 1-R & P \\ R & 1-P \end{bmatrix}$$

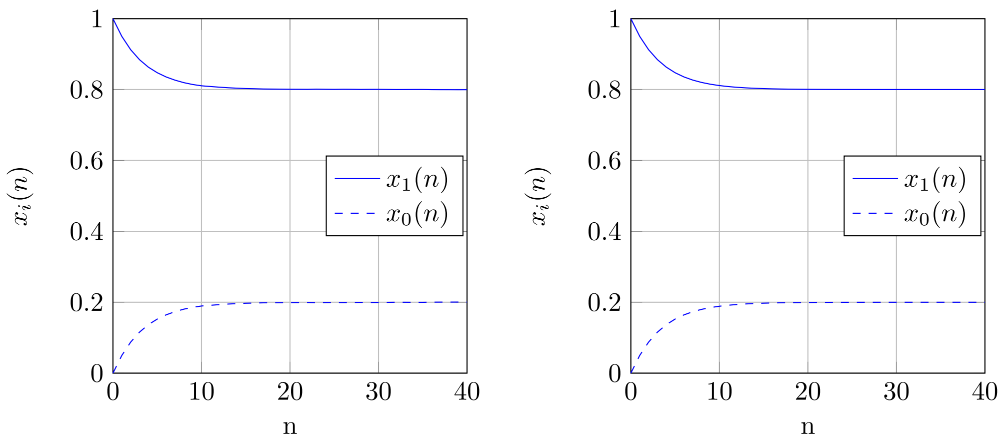
the Figure 2.2 is the contrast of simulation and calculation of one geometric machine with initial state of down with the parameters of breakdown probability $P = 0.05$ and repair probability $R = 0.2$.



(a) Result of simulation (b) Result of calculation

Figure 2.2: Transients of an individual geomatric machine when it is initially down

the Figure 2.3 is the contrast of simulation and calculation of one geometric machine with initial state of up and the paramter is same with the fore figure



(a) Result of simulation (b) Result of calculation

Figure 2.3: Transients of an individual geomatric machine when it is initially up

2.2 two machine model

the Figure 2.4 is the mathmatic model of two machine geometric serial line

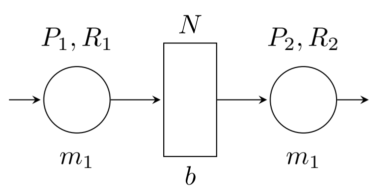


Figure 2.4: State transition diagram of two geometric machine with buffer

the Figure 2.5 is the the result of simulation of two machine with buffer with the paramters of $P_1 = 0.03, R_1 = 0.18, P_2 = 0.06, R_2 = 0.21$, Buffer $N = 10$.

a significant difference can be found between the Figure 2.5(c) and the original Figure 2.6

Parameters of aggregated machines in a two-machine geometric serial line.

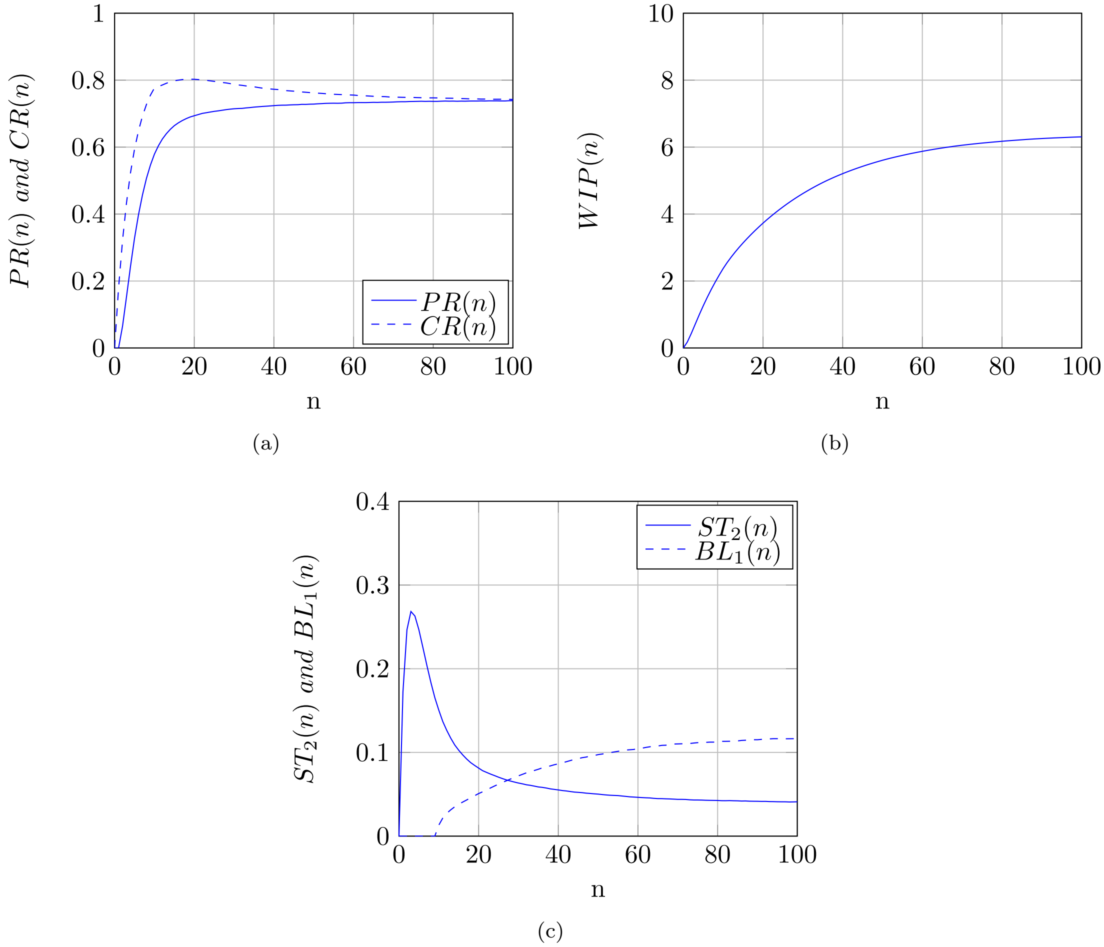


Figure 2.5: Transients of a two-machine geometric line. (a) $PR(n)$ *and* $CR(n)$;(b) $WIP(n)$; (c) $ST_2(n)$ *and* $BL_2(n)$

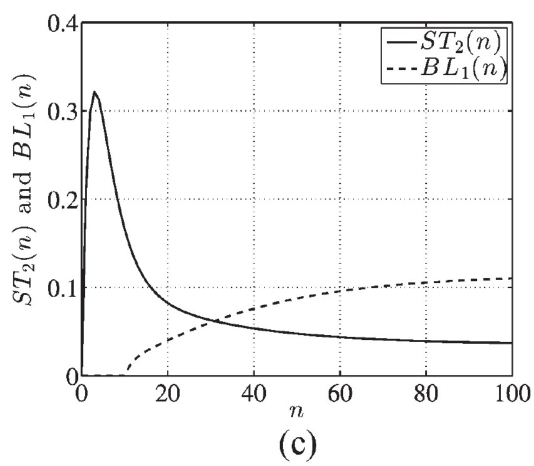


Figure 2.6: Transients of a two-machine geometric line $ST_2(n)$ *and* $BL_2(n)$

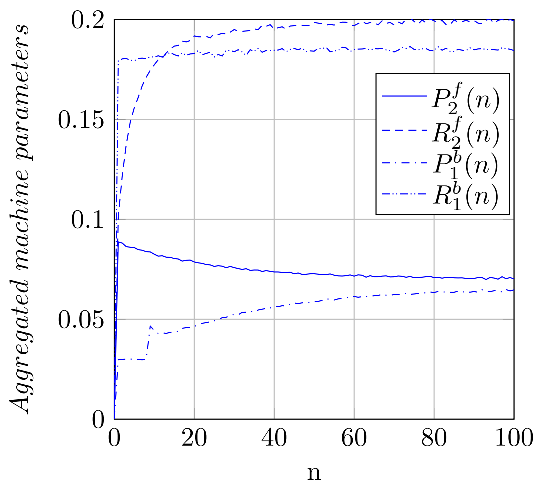


Figure 2.7: Parameters of aggregated machines in a two-machine geometric serial line.

2.3 multi machine model

the following is the part about multi geometric machines with four machine and the parameters are $P_i = 0.05, R_i = 0.2, i = 1, ..., 4; N_i = 5, i = 1, ..., 3$.

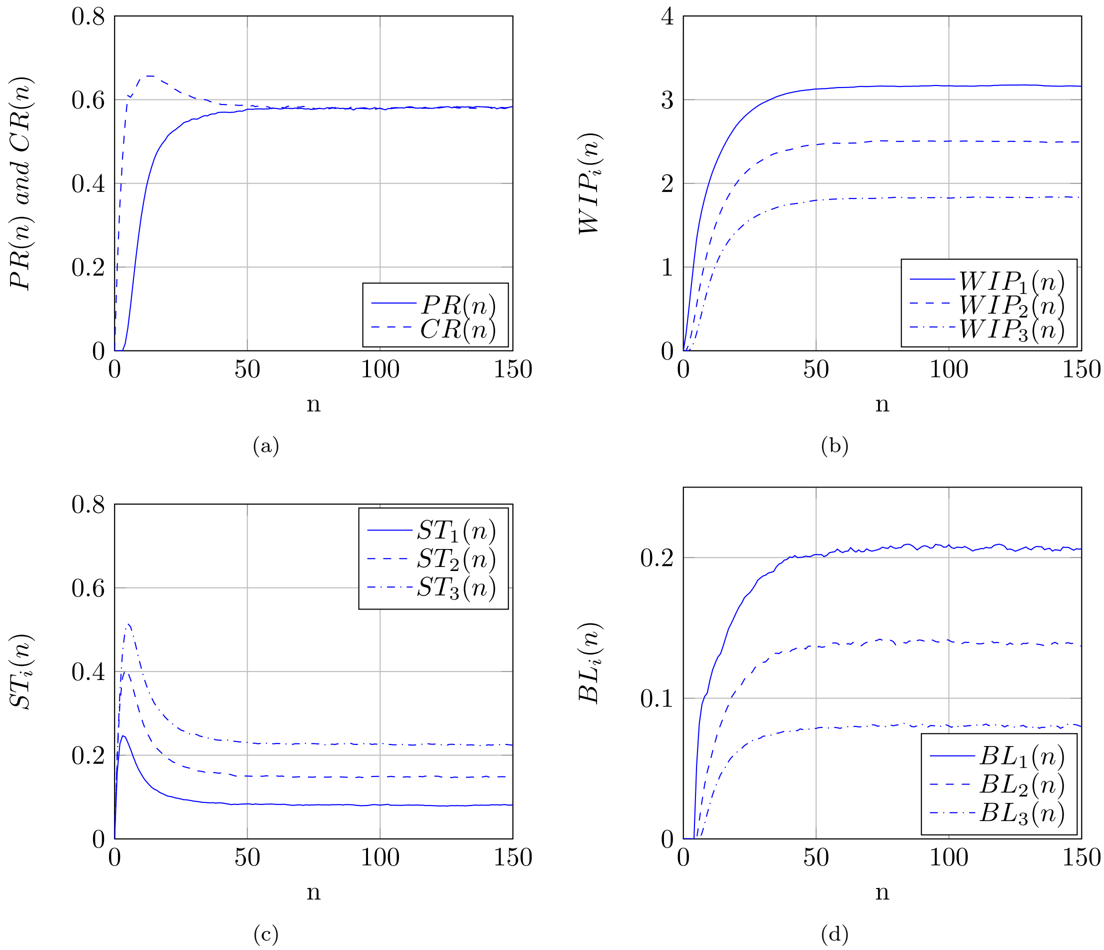


Figure 2.8: Transients of a four-machine geometric line. (a) $PR(n)$ *and* $CR(n)$;(b) $WIP(n)$; (c) $ST_i(n)$;(d) $BL_i(n)$.

meanwhile, the original figures show the result of the writer

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