KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA

Manufacturing Modeling and Simulation in Manufacturing

Thesis submitted in accordance with the requirements of the National Technical University College of Malaysia for the Degree of Bachelor of Manufacturing Engineering (Honours) (Manufacturing Process)

By

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I hereby, declare this thesis entitled "Manufacturing Modeling and Simulation in Manufacturing" is the results of my own research except as cited in the reference.

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ABSTRACT

The role of simulation in manufacturing has expanded in recent years. Design engineers are using simulation to alter their designs to make products easier to manufacture. These studies are used to evaluate alternative solutions to manufacturing problems in areas such as plant layout, scheduling, capacity planning, capital equipment acquisition, inventory management, and supply chain planning. It is possible that two different simulation analysts faced with the same manufacturing problem would perform their case studies differently, obtain different results, and reach different conclusions. This paper presents background on case studies and makes Recommendations concerning the advancement of manufacturing simulation case study methods and practices. There are two main steps in order to accomplish this project. First is manufacturing modeling of the respected area of studies. Second is applying all the data from the model into a simulation. This project starts it movements when each student was given a project title each. Second step is to find any information or theoretical background related to the studies. Next is to design how we are going to carry this study from beginning until the project is successfully developed. There are also some components that need to specify such as methodology, tool will be used and more importantly the selection of software to develop a simulation according to the main objective of this project.

ABSTRAK

Peranan simulasi dalam industri pembuatan semakin berkembang. Jurutera menggunakannya untuk memperbaiki rekabentuk dan memudahkan pembuatan produk. Kajian ini dilakukan untuk menilai kemungkinan dan pilihan penyelesaian terhadap masalah yang timbul di dalam pembuatan seperti susunan kilang, perancangan kapasiti, penjadualan, pendaftar barangan dan pelbagai lagi. Prosedur untuk menjalankan kajian berbeza mengikut organisasi dan keadaan. Setiap kajian yang dialkuakan mempunyai masalah tersendiri, keputusan dan kesimpulan yang dipetolehi juga berbeza. Jilid ini akan menceritakan latar belakang kajian dan penyelesaian yang dicadangkan melalui simulasi pembuatan untuk meningkatkan kemajuan kajian yang dijalankan. Terdapat dua langkah utama di dalam kajian ini. Pertama ialah pemodelan pembuatan terhadap kawasan kajian yang telah dipilih, seterusnya mengaplikasi semua data yang terlibat ke dalam model simulasi yang telah dibuat. Projek ini telah bermula sebaik saja setiap pelajar diserahkan tajuk masing-masing. Seterusnya, segala maklumat dan teori latar belakang kajian dicari dan dikaji. Setelah itu, langkah-langkah untuk menjalankan kajian in dari mula hingga akhir dicorakkan. Terdapat juga beberapa perkara perlu dikenal pasti seperti metodologi, alatan yang digunakan dan pemilihan 'software' simulasi yang sesuai berdasarkan objektif utama kajian.

DEDICATION

Specially dedicated to; My beloved Father, Abu Bakar bin Ali, My Mother, Norsidah bt Muha who are very concern, understanding, patient and supporting. Thanks for everything. To My Brother and All My Friends, I also would like to say thanks. The Work and Success will never be achieved without all of you.

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PROJECT INTRODUCTION

1.0 Introduction

This project incriminates the development of a simulation model that represents a real manufacturing system in industry. This project describes an overview of the use of simulation in the design and analysis of manufacturing systems. Next are methods and approaches used in developing a simulation of manufacturing system.

Modern high technology manufacturing systems, such as those in the electronics, semiconductor, aerospace, and automotive industries, can be extremely complex. The complexity of these systems is due to factors such as: multiple part types made in the same facility/line,

a) numerous manufacturing steps (300-500 steps is not uncommon),
b) batch processing, very complex equipment which leads to high levels of preventive maintenance and downtime,
c) multiple levels of subassemblies.

Models are intended to support management decisions about the system and a single model will often not be capable of supporting all decisions.

Rather, different decisions require different models because various aspects of the design and operation of the system will be important for the questions being asked of the model. While spreadsheet and queuing models are useful for answering basic questions about manufacturing systems, **discrete event simulation** models are often needed to answer detailed questions about how a complex manufacturing system will perform. Simulation models lend themselves to incorporating additional details about the manufacturing system and therefore often give more accurate estimates of manufacturing system behavior than the simpler models. (Fowler)

1.2 Manufacturing issues addressed by simulation

The following are some of the specific issues that simulation is used to address in manufacturing: (Law, 1999)

a) The need for and the quantity of equipment and personnel
b) Number, type, and layout of machines for a particular objective
c) Requirements for transporters, conveyors, and other support equipment (e.g., pallets and fixtures)
d) Location and size of inventory buffers
e) Evaluation of a change in product volume or mix
f) Evaluation of the effect of a new piece of equipment on an existing manufacturing system
g) Evaluation of capital investments
h) Labor-requirements planning
i) Number of shifts

Performance of a manufacturing system evaluation can be made through a simulation model using:

a) Throughput analysis
b) Time-in-system analysis
c) Bottleneck analysis

The evaluations of operational procedures of the manufacturing system are performed in the following area:

a) Production scheduling
b) Inventory policies
c) Control strategies [e.g., for an automated guided vehicle system (AGVS)]
d) Reliability analysis (e.g., effect of preventive maintenance)
e) Quality-control policies

The following are some of the performance measures commonly estimated by simulation:

a) Throughput
b) Time in system for parts
c) Times parts spend in queues
d) Queue sizes
e) Timeliness of deliveries
f) Utilization of equipment or personnel

1.3 Research Problems (Reeb, 2003)

Simulation come in use when:

a) Experimentation with the real system is infeasible, disruptive and too expensive.
b) Other mathematical or analytical method will not work.
c) You need to examine systems as they would operate over a given time frame.
d) You want to compare alternative proposed system design, or alternative operating policies for a single system, to see which best meets the specified requirements.

1.4 Objectives

a) To develop a primary model of a problem area or a small production system using Witness simulation package.
b) To find the capacity of the manufacturing system by using WITNESS
c) To study the effects of varying the design parameters on the performance of the system.
d) To study the effects of comparison the design parameters on the performance of the system.

1.5 Scope

The scope for this project consist using Witness package in developing a simulation of a problem area in manufacturing system and to know clearly about the effects when we using a several types of parameter at different values. Then the design of manufacturing system is normally confronted with the 'what if' question. Physically, to answer such questions will incur high costs. Hence, simulation is used as an alternative. A small production system from a manufacturing system will be selected as case study. Various design options will be tested. For a selected design layout, various design parameters will be changed and the effects will be studied.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter is giving a detail explanation on definition of Manufacturing System, steps to create a model for manufacturing system, how to relate a Manufacturing System in simulation, definition of simulation and reasons to use it, lastly is when and where should be used. The purpose of this chapter is to create an awareness of how simulation is used to visualize, analyze, and improve the performance of manufacturing and service systems.

2.2 Introduction for a Manufacturing System

2.2.1 Introduction

We define a manufacturing system to be a collection of integrated equipment and human resources, whose function is to perform one or more processing and/or assembly operations on a starting raw material, part, or set of parts. The integrated equipment includes production machines and tools, material handling and work positioning devices, and computer systems. Human resources are required either full time or periodically to keep the system running. (Groover, 2001)