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*Cancel the irrelevant words.

OPTIMIZATION ON MANUFACTURING AND ASSEMBLY OF THE EXISTING OUTDOOR SWING

CHEN SIEW TEEN

This report is used to fulfill
part of the requirement in order to be awarded with
Bachelor Degree of Mechanical Engineering (Design & Innovation)

Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

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"I hereby confirm that this report is solely written by me
except those paragraphs and summaries
that have been stated with citation"

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ABSTRACT

This project is purpose to create technical research for undergraduate students which have high potential in technical paper publication. The objective of the final project is to optimize in manufacture and assembly of the existing outdoor swing. Throughout this project, an existing swing will separated each part purpose to do analysis and to critique the assembly point of view. After done the analysis, by using the Boothroyd-Dewhurst method some of the part will eliminate or reduce and redesign remain part as possible and come out with the some conceptual design. To ensure the purpose is achieved, some of the important element must be consider, there are followed the scope of project such as, literature review of the DFMA. In this project, all the design drawing, drawn by using the Solidworks software. Finally, the new design will be compared with the original design from aspect, assembly cost, assembly time, part quantity and design efficiency. Base on calculation, the result had been containing for manual analysis, the percentage of design efficiency is 14 %, and for software analysis, the percentage of design efficiency is 35%. For percentage of part quantity, the result is 29% for both analyses. The result for percentage of assembly time is 52% for manual analysis and 99% for software analysis. Mean while the percentage of assembly cost is 97% for manual analysis and 100% for software analysis. From the overall result, the result obtained in software and manual analysis was not much different. For example, in result of design efficiency, the different values in manual result and software result for concept swing design was not much different. For manual existing design efficiency the result is 28% and for software the result is 26%.

ABSTRAK

Projek ini adalah bertujuan untuk mewujudkan penyelidikan teknikal bagi pelajar yang mempunyai potensi besar untuk penerbitan kertas teknikal. Objektif projek ini adalah untuk mengoptimumkan pengeluaran dan perhimpunan buaian yang telah wujud. Di dalam projek ini, buaian yang berada di pasaran sekarang dipilih dan akan diceraikan satu persatu untuk menjalakan analisis dan memberi sudut pandangan terhadap buaian tersebut. Setelah menjalankan analisa dengan menggunakan kaedah "DFMA", rekabentuk baru dicipta dengan mengeluarkan beberapa konsep rekabentuk untuk mempertingkatkan kos pembuatan dan mengurangkan bilangan pada rekabentuk lama. Untuk memastikan matlamat projek tercapai mengikut ruang lingkup yang bersesuaian, kajian ilmiah yang terdahulu dijadikan sebagai rujukan. Didalam projek ini juga, semua rekabentuk dilukis dengan menggunakan perisian "Solidwork". Pada akhir skali, rekabentuk baru akan dibandingkan dengan rekabentuk sedia ada dari aspek kos pemasangan, kos pembuatan dan kecekapan pemasangan. Berdasarkan analisis yang dijalankan, hasil yang telah diperolehi untuk peratusan kecekapan rekabentuk adalah 14% untuk manual analisis, dan untuk analisis perisian, peratusan kecekapan rekabentuk adalah 35%. Untuk peratusan jumlah bahagian, hasilnya adalah 29% untuk kedua analisis. Keputusan untuk peratusan masa pemasangan adalah 52% untuk analisis manual dan 99% untuk analisis perisian. Sementara peratusan kos pemasangan adalah 97% untuk analisis manual dan 100% untuk analisis perisian. Dari hasil keseluruhan, hasilnya diperolehi dalam perisian dan analisis manual tidak jauh berbeza. Contohnya, dalam keputusan kecekapan rekabentuk, nilai-nilai yang berbeza pada hasil manual dan keputusan perisian untuk rekabentuk yang baru tidak jauh berbeza. Untuk kecekapan rekabentuk manual yang ada hasilnya adalah 28% dan untuk perisian hasilnya adalah 26%.

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σ	=	Stress
δ	=	Displacement
M	=	Moment
r	=	Radius
r̂	=	Radius from the vertex center
R	=	Reaction load
A	=	Area
F	=	Force
e	=	Span length
E	=	Modulus of elasticity
P	=	Concentrated load
y	=	Distance of axis to extreme fiber
L	=	Length
I	=	Moment of Inertial

LIST OF ABBREVIATIONS

DFMA	=	Design for manufacturing and assembly
DFA	=	Design for assembly
DFM	=	Design for manufacturing
BDI	=	Boothroyd Dewhurst Inc
ECN	=	Engineering change notice
CE	=	Concurrent engineering
EDS	=	Engineering design specification
PDS	=	Product design specification
QFD	=	Quality Function Deployment
CAD	=	Computer aided design
FEA	=	Finite Element Analysis
FOS	=	Factor of safety

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND

The wave of modernization that is prevalent in our lives is also affecting our children's lifestyles, most kids are fascinated with video games and indoor entertainment they are no longer sociable.

This is where children's outdoor swings would fill in the missing link. As a parent one must understand that an outdoor experience is something that will develop the growth of a child's social awareness and behavior. It all starts in interactions with neighbors and classmates for those who are already going to school. However prior to coming to school a child's mind should already be prepared to interact with other children and one way of doing this is to engage your child into outdoor activities. Children's outdoor swings are great for all ages, it is a tool to capture the attention of your children and make them realize the significance of interaction between people.

These tough outdoor play swings great they are carefully crafted by skilled professionals to stay for a lifetime helping you turn your everyday life with kids into memories of fun and entertainment. Over the years there was no successful replacement for children's outdoor swings. There is no virtual substitute for real equipment that encourages or improves social well being. Although everything that happens around us are all dependent on the state of the mind it is important to consider the enjoyment provided of our sense of touch, hearing, and sight. These senses are important and it contributes to the basic requirements of our social development. The virtual entertainment provided by computers, video games and televisions are merely virtual, they are a good motivation to practice our mental state but they are unreal and you cannot feel them, you just see it but it is more like an abstract you would not feel it at all.

The children's outdoor swings will not only entertain but also put your child's cardio vascular system to work; it will become a form of an exercise that your child will appreciate. (Source: http://ezinearticles.com/?Childrens-Outdoor-Play-Sets&id=4053741)

Design for Manufacturing (DFM) and design for assembly (DFA) are the integration of product design and process planning into one common activity. Designing for manufacturing and assembly (DFMA) can define as a process for improving product design for easy to manufacture and low cost assembly, focusing on functionality and on assimilability concurrently.

The goal of DFMA is to design a product that is easily and economically manufacture and assembly. On the other words is to improve the design of the assembly, to reduce the adhesion such as welding operation necessary to end up with a finished product. The most common methods of improvements are reducing the number of times the part has to be reoriented, and eliminating any excess material without sacrifice the product quality (Source: John W. P. & Sanchez J., (2001)).

The importance of design of designing for manufacturing and assembly is underlined by the fact that about 70% of manufacturing cost of a product (cost of materials, processing, and assembly) is determined by design decision, with production decisions (such as process planning or machine tool selection) responsible while decisions made during production only 20%. Further, decisions made of the product's cost, quality and manufacturability characteristics.

Designing parts for use in a flexible automation system can have profound results on the overall effectiveness of the system. While simply attempting to automate the assembly of existing designs is possible, the resulting operation is often prone to error and continual failure. More than often, the root of many of the problems can be traced back to the parts and assembly procedures being used.

In the past, design and manufacture tasks have been performed independently. In this scenario, the designer designs a product and ‘‘tosses it over the wall’’ to the manufacturer to produce. There is no interaction between the designer and manufacturer and often what results is a design that is difficult to produce using automation. What is required is collaboration between all aspects of the engineering staff, beginning with product conception all the way through delivery. By tapping into the expertise of all engineering areas (design, automation, manufacturing and etc), an equally functional and high quality design will result, but it will be much easier to reliably manufacture in an automated system. In practice, this approach is often difficult to implement, especially if the product designers are employed by one sub-contractor, the machine builders by another, and the raw components manufactured by a third. However, time spent by all involved parties in mutual consultation at the design phase will far outweigh and inconveniences.

Many times the objections to this approach to manufacturing come from the designers and those in marketing who have a preconceived idea that they will lose control. Their preliminary job function is to produce a product that the consumers will desire. However, this notion is often in error. The knowledge gained into the manufacturing process will far outweigh any ill effects. Making a part more manufacturable does not always mean a complete redesign. Alterations in part designs do not have to be drastic. For example, only a slight redistribution of mass may be necessary to improve the probability of a particular stable rest position, thereby improving flexible feeder throughput. Or a slight shifting of a vision registration fiducially can be sufficient to provide an asymmetry which can be used to determine pose. Or a larger chamfer can vastly improve the reliability of an assembly task. These types of small changes to a design can have a major impact on the quality and ease of automated manufacture.

Engineering design is a process of developing a system, component, or process to meet desired needs. It is a decision making process in which basic sciences, mathematic, and engineering technologies are applied to convert resources optimally to meet a stated objective. Engineering design had usually been complete purely based on the process-planning department and then to the manufacturing department. These activities were completed in a sequential manner with no feedback given to the designer. Sometimes the designed product is extremely difficult to manufacture and the manufacturing cost is unnecessarily high. To solve this problem, two approaches are used to help the designer reducing the product cost after a design is completed. They are value engineering and producibility engineering. (Source: Boothroyd, G. *et. al*., (2002))

Value engineering is primarily concerned with product function and costs. Producibility engineering, on the other hand, assures that product specifications can be met with available or potentially available techniques, tooling, and test equipment at costs compatible with the product's selling price. By using value and producibility engineering, design engineers attempt to optimize the design to maximize the profit of accomplishing intended functions. However, three problems are encountered in the traditional manufacturing system using value and producibility engineering. First, such optimization, if not carefully monitored, could be accomplished at the expense of product manufacturability. Second, implement of value engineering is usually stated as a company policy but not strictly followed in a scientific manner; therefore, the most significant savings may not be achieved (Source: John W. P. & Sanchez J., (2001)). Third, although value engineering and producibility engineering are highly valid methods in themselves, they enter into consideration too late in the traditional manufacturing system, i.e. after the product design has been completed. This makes it more expensive to modify the design (at large stage) and it also delays the launch of a new product to the market. A new approach of DFM, integrates the manufacturing considerations into the design process to overcome these shortcomings.