



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**THE APPLICATION OF TIME COMPRESSION
TECHNOLOGIES OF AN ARTIFACT IN MALAY CARVING
(MOULD OF 'PAPAN PEMANIS')**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology
(Manufacturing Product Design) (Hons.)

by

MOHAMMAD SYAFIQ BIN MOHD SARIF

B071110417

890212-10-5101

FACULTY OF ENGINEERING TECHNOLOGY

2015

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Manufacturing Product Design) (Hons.). The member of the supervisory is as follow:

.....

(Project Supervisor)

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: The Application of Time Compression Technologies (TCT) for Data Acquisition of An Artifact in Malay Carving (Mold for Papan Pemanis)

SESI PENGAJIAN: 2014/2015 Semester 1

Saya **MOHAMMAD SYAFIQ BIN MOHD SARIF**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

- SULIT** (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
- TERHAD** (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
- TIDAK TERHAD**

Disahkan oleh:

Alamat Tetap:

No. 39 Jln Sri Bayu 8, Tmn Sri Bayu,

Bagan Lalang, 43950 Sg. Pelek

Sepang, Selangor.

Cop Rasmi:

Tarikh: _____

Tarikh: _____

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled “The Application of Time Compression Technologies (TCT) for Data Acquisition of An Artifact in Malay Carving (Mould for ‘Papan Pemanis’)” is the results of my own research except as cited in references.

Signature :

Author’s Name : Mohammad Syafiq Bin Mohd Sarif

Date :

DEDICATION

To my beloved parents, Mohd Sarif Bin Jantan and Seliah Binti Gani,

To my siblings Izzat Faris, Khabir Thariq, and Dinie Akmal,

To my supervisor, Mr. Hambali Boejang,

To Mr. Zulkifli Samad as carving marker,

and my fellow friends.

ACKNOWLEDGEMENT

First and foremost, Alhamdulillah, I would like to praise Allah for giving me the strength to endure the Projek Sarjana Muda (PSM) period with a great success. It is known that, this PSM is one of the most important subjects that must be endured by all UTeM's students as requirement to get a degree.

I would like to thank to my project supervisor Mr. Hambali Bin Boejang for his commitment, support, advice, time shared and guidance given. He helps contribute lots in order to complete this project successfully. Not forgotten, for all lectures and technicians involves with their invaluable support, cooperation, shared of information and also their experiences.

I would also like to express greatest thankful to my beloved parents, Mr Mohd Sarif Jantan and Mrs Seliah Gani for giving me their support and motivation during my good and hard times in order to ensure completion of this project. Not forgotten, special thanks to Mr. Zulkifli Samad as carving marker in order to give information about Malay Carvings. Furthermore, thanks to all who directly or indirectly help in contribution and full support though the project period.

Lastly, I would like to apologize for my wrong-doing and mistake during this PSM period. I hope all knowledge and experience that I gathered in this PSM can help me in my career in the future.

Thank you again.

Wassalam.

Mohammad Syafiq Bin Mohd Sarif

ABSTRAK

Concurrent Engineering (CE) jelas telah memberi kesan ke atas rekabentuk dan pembangunan produk seperti mengurangkan masa melahu, meningkatkan kualiti dan mengurangkan kos. Pada trend masa kini, banyak pengeluar telah menggunakan atau mengaplikasikan *Time Compression Technologies (TCT)* seperti *Reverse Engineering (RE)*, *Computer-Aided-Design (CAD)*, dan *Rapid Prototyping (RP)*. Oleh yang demikian, Projek Sarjana Muda ini dijalankan untuk memperolehi data artifak didalam seni ukiran Melayu. Selain itu, projek ini juga adalah untuk melaksanakan *TCT* dalam membuat acuan untuk Papan Pemanis untuk menentukan masa yang diperlukan dalam membuat acuan tersebut. Bagi menyempurnakan kerja kajian ini, perbandingan dari segi ukuran akan dilakukan diantara acuan daripada prototaip dan acuan yang sebenar. Kajian ini menunjukkan bahawa kaedah moden lebih baik daripada kaedah tradisional dari segi masa yang diperlukan untuk membuat acuan Papan Pemanis.

ABSTRACT

The impact of Concurrent Engineering (CE) on product design and development are obvious such as decreased lead time, improved quality, and reduced cost. The trends of today, many manufacturers has adopting the related Time Compression Technologies (TCT) such as Reverse Engineering (RE), Computer-Aided-Design (CAD), and Rapid Prototyping (RP). Thus, this Bachelor Degree Project was conducted to apply TCT in data acquisition of an artifact in Malay carving. Furthermore, this project is also to implement TCT in developing a mould for 'Papan Pemanis' in order to determine time taken to produce the mould. To complete the research work, comparison in term of measurement will be conducted between prototype mould with actual mould. This study shows that modern approach much better than traditional method in term of time taken to produce a mould of 'Papan Pemanis'.

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ABS	-	Acrylonitrile Butadiene Styrene
BFB	-	Bits From Bytes
CAD	-	Computer Aided Design
CE	-	Concurrent Engineering
CMM	-	Coordinate Measurement Machine
TCT	-	Time Compression Technologies
SOP	-	Standard Operation Procedure
3D	-	Three Dimensional
USB	-	Universal Serial Bus
RP	-	Rapid Prototyping
STL	-	Standard Triangulation Language
IGES	-	Initial Graphics Exchange System

LIST OF FIGURES

- 2.0(a) Carving for building
- 2.0(b) Carving for weapon
- 2.0(c) Carving for music instrument
- 2.1 Daun Pecah Periuk pattern
- 2.2 Pucuk Kacang pattern
- 2.3 Bunga Ketumbit pattern
- 2.4 Bunga Bayam Peraksi pattern
- 2.5 Traditional work process flow for making a mould
- 2.6 Mould that will be use foe Timber Bracket ‘Papan Pemanis’
- 2.7 The edge of the ‘Papan Pemanis’ mould
- 2.8 Carving at entrance of house
- 2.9 Schematic diagram of integrated RE within rapid product development process
- 2.10 Touch probe contact scanning
- 2.11 Example point of cloud of water pump that produced by contact technique
- 2.12 Non-contact scanning device
- 2.13 Schematic diagram of simple laser triangular
- 2.14 Example of point of water pump that resulting from non-contact technique
- 2.15 The schematic diagram of triangle tessellation of STL file
- 2.16 Schematic diagram of overall RP process chain
- 2.17(a) Schematic diagram of SLA
- 2.17(b) The SLA5000 machine
- 2.18(a) Schematic diagram of 3D printing
- 2.18(b) Printing machine
- 2.19(a) Schematic diagram of FDM
- 2.19(b) FDM machine

- 3.0 Project methodology
- 3.1 Books and journals
- 3.2 Partial panel mould
- 3.3 Leader Metrology CMM machine
- 3.4 Mould have been clean
- 3.5 Camera (grey colour) have been installed
- 3.6 Calibration ball
- 3.7 Calibration interface
- 3.8 Laser and camera at middle on the ball
- 3.9 Calibration line
- 3.10 Begin position
- 3.11 Distance position
- 3.12 Edge position
- 3.13 Scanning path generated
- 3.14 Start scan tab
- 3.15 Scanned data of mould
- 3.16 Geomagic software interface
- 3.17 Selected area to delete
- 3.18 Fill holes tab
- 3.19 Selected area to be filled
- 3.20 Surface had been upgraded
- 3.21 Create patch layout
- 3.22 IGES file format
- 3.23 Imported curve of the IGES data
- 3.24 Selected entities
- 3.25 Extrude boss of mould
- 3.26 Top plan view of mould
- 3.27 Corner shape before editing
- 3.28 Corer that had been trim
- 3.29 STL file description
- 3.30 Bits for bytes machine
- 3.31 Interface magics RP 17.02 software

- 3.32 Parameter in dialog box
- 3.33 Cutting line
- 3.34 Part pages dialog box
- 3.35 Mould cut 1 part orientation
- 3.36 Build setting parameter
- 3.37 Estimated build time for cut 1
- 3.38 Cut 2 part orientation
- 3.39 Cut 3 part orientation
- 3.40 Cut 4 part orientation
- 3.41 Save built G code tab
- 3.42 Cube stick for 3D printer
- 3.43 Glue on platform
- 3.44 USB slot for thumb drive
- 3.45 BFB Machine user interface
- 3.46 Prototype
- 3.47 Digital vernier caliper
- 3.48 Dimension for thickness
- 3.49 Selected features

- 4.1 Prototype mould
- 4.2 Build time for part 1 (cut 1)
- 4.3 Build time for part 2 (cut 2)
- 4.4 Build time for part 3 (cut 3)
- 4.5 Build time for part 4 (cut 4)
- 4.6 Traditional method
- 4.7 Modern method
- 4.8 3D CAD mould

LIST OF TABLES

1	Build time for both mould	65
2	Dimensional of difference feature in difference test	68

TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	viii
List of Figures	ix
List Abbreviations, Symbols and Nomenclatures	xii
CHAPTER 1: INTRODUCTION	1
1.0 Introduction	1
1.1 Objective of Project	2
1.2 Scope of Project	2
1.3 Problem Statement	3
CHAPTER 2: LITERATURE REVIEW	4
2.0 Introduction	4
2.1 Introduction to Art of Malay Carving	4
2.1.0 Interview	7
2.1.1 The Mould Fabrication Works	9
2.2 Concurrent Product Development Time Compression Technologies	12
2.2.0 Introduction	12
2.3 Reverse Engineering (RE)	13
2.3.0 Introduction	13
2.3.1 Scanning Phase	14
2.3.2 Point Cloud Data and Digitising	18
2.4 Computer Aided Design (CAD)	19
2.4.0 Introduction	19
2.4.1 Fundamental and Basic Principle of CAD	20
2.4.2 The Application of CAD	21
2.4.3 Standard Triangulation Language (STL)	21

2.5	Rapid Prototyping (RP)	22
2.5.0	Introduction	22
2.5.1	Overview of RP Process Chain From CAD to Prototype	23
2.5.2	Rapid Prototyping Machines	24
CHAPTER 3: METHODOLOGY		30
3.0	Introduction	30
3.1	Formulation	32
3.2	Identification Scanned Object / Product	33
3.3	Scanning	34
3.3.1	Scanning Process Procedure	35
3.4	CAD data Manipulation	41
3.4.1	Data Manipulation Experimental Wok	41
3.4.1.1	Trim	41
3.4.1.2	Editing	45
3.5	Prototype Fabrication	49
3.5.1	Rapid Prototyping Process	50
3.5.1.1	Pre-Processing	50
3.5.1.1.1	Slicing	50
3.5.1.1.2	Generate BFB Fie	52
3.5.1.1.3	Fabricate Prototype	56
3.6	Analysis	60
3.6.1	Work Procedure for Analysis	60
CHAPTER 4: RESULT AND DISCUSSION		62
4.0	Introduction	62
4.1	Prototype	62
4.2	Lead Time	63
4.2.1	Comparisons between actual mould with prototype mould	65
4.3	Dimensional Accuracy	68

CHAPTER 5: CONCLUSIONS AND RECOMMENDATION	70
5.0 Conclusion	70
5.1 Recommendation	71

REFERENCES	72
-------------------	-----------

APPENDIXES

1. Gantt Chart
2. Types of Carving Pattern
3. Interview Question
4. User Manual BFB Machine

CHAPTER 1

INTRODUCTION

1.0 Introduction

The application of Concurrent Engineering (CE) in product design and development has given significant impact on the entire product planning process. Most of the manufacturers has practiced CE by adopting Time Compression Technology (TCT) in product design and development process because it decreases lead time, improved quality, and reduced cost (Boejang H., Basar M. F., 2013). Many industries have achieved remarkable advantages after implementing CE in their new product development process. By executing design in parallel, improvements occur in many areas such as communication, quality, production processes, cash flows, and profitability. The reductions of time to market which has strategic importance, allows companies to increase their market share and reduce design changes and iterations [Boejang H., Basar M. F., Yahya M.S., 2013).

In this Bachelor Degree Project (BDP), several CE tools will be used such as Reverse Engineering (RE) Computer Aided Design (CAD), and Rapid Prototyping (RP). RE refers to creating a CAD model from an existing physical object, which can be used as a design tool for producing a copy of an object, extracting the design concept of an existing model or reengineering an existing part (Moitinho, V., & Barcelo, J. A., 2010). Meanwhile, RP refers to a technology used to produce a physical model or prototype directly from three-dimensional Computer Aided Design (3D CAD) data (Singh N.).

This project is carried out to understand the application of TCT in the product development process on an artifact / hand made product. The selected product for this case study is a mould that is needed in making sketch on 'Papan Pemanis'

1.1 Objective of Project

There are two objectives that have to be achieved in this Bachelor Degree Project :

1. To produce prototype of 'Papan Pemanis' mould by using Bits from Bytes (BFB) Machine model 3D Touch Double.
2. To compared lead time of traditional method in fabrication process of mould against modern approach.

1.2 Scope of Project

The work scopes of this project are :

1. Literature Reviews.
2. Interview sessions.
3. Select hand craft product to be studied.
4. Design and develop mold for selected product (papan pemanis) using TCT.
5. Compare time taken to produce the mold (master pattern).

1.3 Problem Statement

RE is the process of extracting missing knowledge from anything man-made product or physical object such as CAD data (Moitinho V. Barcelo J. A., 2010). Thus, this project focuses on getting CAD data from a master pattern of a 'Papan Pemanis' and maintaining the quality of the human touch in mould making process. Furthermore, the craftman takes a long time to make a mould in which it requires one or two days lead time, depending on the types of carving works. Nowadays, many young people are less or not interested in the art of carving. So it is not impossible in 5 to 10 years from now this art will extinct because there is less interest in this artistic activities. There are young people who know make sculptures but do not know how to make a mold. So, the mould is the most important tool before making a carving, especially in the fabrication of 'Papan Pemanis'.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter covers explanation on how information are gathered. The informations will be used as a guidelines in order to complete the research work. The main source of information was identified as following:

1. Books.
2. Journals.
3. Interview.

2.1 Introduction to Art of Malay Carvings

This chapter gives some insights on the wood handcraft products that is used in traditional Malay house. It explain and discusses the method on how information are gathered on Malay wood craftmanshift, the mould making for ‘Papan Pemanis’, and types of patterns and products.

Some of the methods in gathering raw data or information are through literature review, interview, focus group and observations. For this project, the selected method in order to getting the informations about malay carving is

interviews. This interview was conducted at the Malacca Traditional House where it is dedicated to locate the wood carving industry and its' products. The location of this house is on the opposite of the Perigi Hang Tuah, Kampung Duyung, Melaka. Figure 2.0 (a), (b) and (c) below shows some of the wood carving products that were produced by Mr. Zainal Samad :



Figure 2.0(a): Carving for building.

(Courtesy from: Mr. Zulkifli Samad)



Figure 2.0(b): Carving for weapon.

(Courtesy from: Mr. Zulkifli Samad)



Figure 2.0(c) : Carving for music instrument.

(Courtesy from: Mr. Zulkifli Samad)

2.1.0 Interviews

One of the renowned sculptors is Mr. Zulkifli Samad, 44 years old. He has involved in this field since he was 10 years old at the time where he just a helper to his father. The wood carving in Malay tradition is applicable in the production of decorative items such as ‘Papan Pemanis’, Malay traditional weapons, and music instruments. These products are used for various purposes. For example, traditional Malay house, and the theme used in wood carving is unique and distinctive. In earlier times, carving is very symbolic to certain society; and in Melaka, the theme used in a particular wood carving work is based on flora and fauna. The interviews were conducted merely to understand the wood carving process for decorative items for the traditional Malay house.

The process is the mold making process for the production of ‘Papan Pemanis’. There many types of carving patterns that normally used in making ‘Papan Pemanis’ for traditional Malay house or building. Most of them are used mainly as partition panels, and timber bracker. These are shown in Figure 2.1, 2.2, 2.3 and 2.4. The other types of carving patterns are shown in appendix 2.

1. Partition panel

- a. Daun Pecah Periuk.



Figure 2.1: Daun Pecah Periuk pattern.
(Courtesy from: Mr. Zulkifli Samad)