



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

# **Laser Cutting Of Woods**

Thesis submitted in accordance with the requirements of the Universiti Teknikal  
Malaysia Melaka for the Degree of Bachelor of Engineering (Honors)  
Manufacturing (Process)

By

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Faculty of Manufacturing Engineering

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**JUDUL: LASER CUTTING OF WOODS**
**SESI PENGAJIAN: 2007/2008**

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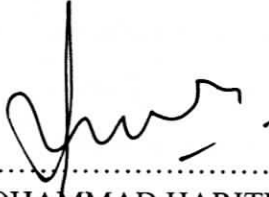
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## DECLARATION

I hereby, declare this thesis entitled “Laser Cutting of Woods ” is the result of my own research except as cited in the reference.

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## ABSTRAK

Projek ini akan memperihalkan kajian tentang pemotongan kayu menggunakan sinar laser . Sebagai rujukan , projek ini akan dibuat di bengkel mesin shop di UTEM bertempat di makmal fasa B. Mesin yang digunakan adalah jenis pemotongan laser Heliuss 2513 Hybrid buatan Jerman dibekalkan oleh LVD Company Sdn Bhd , Malaysia. Tujuan kertas kerja ini adalah untuk mengetahui tentang pemotongan laser terhadap kayu dan mencari keadaan terbaik untuk pemotongan laser terhadap kayu . Kajian terperinci telah dibuat dalam eksperimen pemotongan laser terhadap kayu ,sebarang perubahan yang terjadi dan kesan-kesan pemotongan laser terhadap kayu . Kayu yang digunakan adalah jenis merbau,jati dan plywood dan kayu-kayu ini terdiri daripada spesies kayu jenis keras .Daripada pemerhatian , keadaan terbaik pemotongan laser terhadap kayu di kenal pasti.Ada beberapa ukuran diambil kira iaitu ketebalan kayu , kelajuan ,kekuatan gas , frekuensi dan Kitaran tugas .

## ABSTRACT

This project describes about the application of “ Laser Cutting of Woods ” . As a preference, this project will be held in the Machine Shop lab in UTEM located in Fasa B. The type of machine used in this research is a series of Helius 2513 Hybrid Laser Cutting Machine made from Belgium purchase from LVD Company Sdn Bhd , Malaysia . The purpose of this research is to find out the laser cutting of woods and to find out the optimum condition for laser cutting of woods .The woods that had been used in this experiments were merbau , jati and plywoods which all woods are a hardwood species . Detailed investigations have been conducted to find out any effects in laser cutting of woods . From observations , the optimum conditions for laser cutting of woods were find out . Some parameters have been referred like the material thickness ,the speed , gas power , frequency and Duty cycle .

## **DEDICATION**

*For my supervisor, lecturers, family and friends*

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Assalamualaikum w.b.t. and warm greeting,

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Lasers , are devices that generate or amplify light , just as transistors generate and amplify electronic signals at audio , radio or microwave frequencies . Here light must be understood broadly , since lasers have covered radiation at wavelengths ranging from infrared range to ultraviolet and even soft x – ray range . Since the first operational laser was built in 1960 , the machining technology has advanced at a rapid rate and is the one of the most versatile developments at our disposal .It belongs to the large family of material removing process under the non – traditional machining .

Laser machining is a thermal , a non – contact and a flexible process . These unique characteristics make laser beam themselves possible to produce new material removal methods . The laser machining also can replace mechanical material removal methods , particularly in the processing of difficult – to - machine materials such as hardened materials , ceramics , and composites.

Laser Cutting is one of the process that cut materials through thermal cutting process resulting in higher quality and precision than any other thermal cutting processes. Lasers emitted an intense , coherent, highly collimated beam of single wavelength light that is focused by an optical lens to produce a small , intense spot of light at particular laser beam diameter on the work piece surface .Laser light , incident on the material , may be

reflected , transmitted or absorbed .Upon laser impact on the work piece surface , optical energy is converted into heat energy and temperature generated is rise higher enough to melt or vaporize any material.

The laser in theory and construction combines the principles several disciplines . In theory , the laser is based on physics and electronics . In construction , it incorporate electronics , optics , chemistry and even fluid . Light Amplification by Stimulated Emission of radiation describes a wide range of devices . Practically speaking , lasers contain three key elements . One is laser medium itself , which generates the laser light . A second is the power supply , which delivers energy to the laser medium in the form needed to excite it to emit light . The third is the optical cavity resonator , which concentrates the light to stimulate the emission of laser radiation . All three elements can take various forms , and although they are not always immediately evident in all types , their functions are essential . There are many different types of lasers, but they all share a basic element, each contains a material capable of amplifying radiation but basically lasers convert electrical energy into high energy density beam of light through stimulation and amplification .

## **1.2 Problem Statement**

Considered as a trade or skill ,woodworking dates back to when wood was the best material available for building dwellings ,for the construction of large mechanical devices such as windmills ,smaller ones such as ploughs ,and for making equipments such as buckets , and domestic furniture ,initially of very rudimentary design . From earliest times , the versatility of wood has meant that the skilled woodworker is much in demand to make every kind of construction or device designed to achieve greater comfort ,both indoors and out.

Whatever the woodworker's skills , the techniques related to carpentry have involved. The furniture industry also becomes more bigger and many customers requirements must be fulfilled. So a little study about 'laser cutting of woods ' had been conducted to get more knowledge. With this research , many problems in furniture industry can be solve. And from this research , the information from the experimental work can be used in the future .

### **1.3 Objective**

The aim of this project is to study the laser cutting of woods process The main objectives were:

1. Get a knowledge and to study the cutting process of woods using laser .

### **1.4 Scope**

Now days the laser technology is growing rapidly and extensively used for various applications such as cutting , drilling , surface treatment , ablation and so on . Laser are widely used in industry as cutting tools due to ultra flexibility of the cutting conditions , obtaining high quality end product, quick set up , non – mechanical contact between the work piece and the tool , and the small size of the heat affected zone . Nevertheless , one has to know in detail about the quality of finished product with various types of material and thickness in laser cutting of woods .In this experiments the scope is in the laser cutting of woods .The experiments is more on CO<sub>2</sub> laser cutting . The aim of this project is a little study and get a knowledge in laser cutting of woods .

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction of laser

##### 2.1.1 What is Laser

Since the first laser was demonstrated in 1960 , lasers have become useful in many areas of human endeavor , from medicine to manufacturing to music recording . Laser – based systems transmit intercontinental telephone conversations , or detect trace amounts of toxic gases in the atmosphere , as well as probing the deepest secrets of chemical reactions at the molecular level . Such versatility has led many scientists and engineers to work on the design , understanding and applications of laser in the past few decades , and the pace of developments is still rapid . The figure 2.1.1 a) below show the physicist who invented laser.



Figure 2.1.1 a) An Us physicist who invented laser , Theodore Maiman

Why are lasers so special? Lasers produce light , just as an incandescent light bulb does . However , the light emitted from a laser has certain characteristics which make it valuable in many applications . It is coherent , directed and monochromatic . These characteristics mean that it can be focused tightly to a small spot , or allowed to propagate over a long distance , such as to the moon and back . Laser light can also be concentrated in short pulses with high peak power , or can operate continuously .

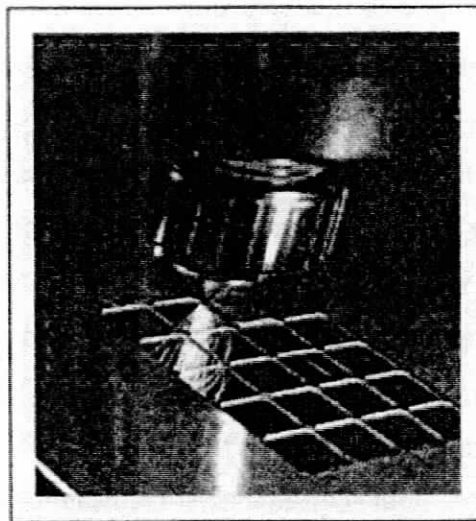


Figure 2.1.1 b) Example an application of laser

LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Laser light differs from ordinary light in that it consists of photons that are all at the same frequency and phase (coherence).A laser 's stability to produce coherent light is based upon the principle that photons of light can stimulate the electrons of atoms so they emit photons of the exact same frequency .

The word 'laser' contains the phrase of two key ideas : the concepts that a laser involves making an amplifier for light and the process by which that occurs , stimulated emission