The Invention of Semi-automatic Lathe Wood

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Abstract

This research aims to study the condition of semi-automatic lathe wood and to develop a semi-automatic lathe wood to be effective in processing wood products. It is an experimental research in which a semi-automatic lathe wood was experimented with eucalyptus, mango, acacia, tamarind and teak wood and their components. The dependent variable and performance level testing are independent variable. From the experimenting of the wood suitability in both the X-axis and Z-axis directions, it was found that duration, length and depth are related to the blade size. The ideal wood for turning is a trial with a 35 mm X-axis blade size. The smallest wood that can be turned is a teak of 22mm. within the specified working time of 4 minutes in the Z-axis coordinate of 40 mm. While the shortest wood turned within the same time is also a teak of 32 mm. In conclusion, a teak is the most suitable wood for turning work; the wear of the wood turning knife in the X-axis, was related to the hardness of the wood which shows that wear varies with the wood hardness; while in the Z-axis, hardwoods as teak and tamarind do more damage to the blade than eucalyptus, acacia, and mango woods. The semi-automatic lathe wood developed by researchers can be used more effectively, faster, and better in production applications for a suitable wood as teak that can provide the smallest and shortest wood. Therefore, this semi-automatic lathe machine can be used in the process of producing sawn timber efficiently and rapidly as a product of the Nasom Village Community.

Keywords : semi-automatic lathe machine, lathe wood, teak wood, wear, woodturning knife

Introduction

There is a lot of industrial development in Thailand, nevertheless it is still inefficient and needs development in some aspects, such as the technology and the production efficiency. The growth of the industry is another characteristic of the industrial development of various countries. Industrial development is one of the key goals of development and leading to economic growth. Efficient use of available resources is therefore an important way to achieve economic prosperity and lead to other development. From the past, machines were used and played a very important role in the industrial sector to replace the lack of labor and to operate more efficiently. Most factories do not use modern technology due to the low budgets and lack of standard training personnel. Traditional work is manual labor and relying mainly on old knowledge (Daniel Lerner. 1958). As a result, the work is not on time and the product is of low quantity and quality. Habitual work causes problems while machines that are not suitable for the job cause damage and need to be repaired as waste. Therefore researchers have an aim to find different types of wood on the lathe, solutions to reduce costs, labor, time, and use the machine correctly for the maximum benefit (Songchai Saetang. 2016). As the government has a policy to protect the machinery manufacturing industry including the dumping the major exporting countries, Thailand began to export more processed wood products from a surplus of domestic production. In addition to receiving export quotas from the agreement on trade in timber products, as a result, Thailand's exports of such goods grew rapidly. At present, villagers in Nasom Community, Chai Badan, Lopburi use a simple traditional wood lathe, as a result, turning various types of wood used for producing community products, souvenirs, including furniture do not support the demand for distribution and household income. The research team realized the importance of studying and developing a semi-automatic lathe wood to benefit the needs of the villagers in Nasom Village Community in the production of lumber to be more efficient and faster as well as expanding on the development of knowledge in the use of semi-automatic lathe woods. This will create a balance in turning wood work pieces and perfect machine conditions, shorten production times, and achieve more quality work.

From the research on "The Analysis of Surface Wear Parameters of Press Tools in Fine Milling" by Paw Wilkinson (1996), it was found that the variables that affect the end mill wear are cutting speed, feed velocity, depth of cut, and feed per tooth. The machining distance and metallurgical properties of the end mills obtained from research shows that if the main structure of the end mill is marten site and carbide, there will be a different decomposition. Consistent carbide degradation structures with a small difference in size will affect wear. Due to less shear than large carbide end mills with uneven decay, the martensitic structure of high cycle steel is very hard and the choice of cutting tool material in metal cutting processes with the aim of the research study of various factors affected the selection of metal cutting tools in industrial applications. From the experimental results, it was found that factors affecting the selection of cutting tools were geometric shapes, (various shapes and sizes of knives), material of the cutting knife, the coating on the handle of the knife handle, the material of the work piece to be manufactured, and most importantly, the machining conditions. They are classified as bend radius, knife tip, knife setting angle, rake angle, relief angle, and wedge angle with cutting depth, feed (r/min), feed speed (mm/min) and cutting speed (mm/min).

Furthermore, from Kongrit Nakhonchai (2016) research on basic lathe (RIT 1-M200) which is a manual controlled lathe that can be controlled by computer or CNC Lathe with less tolerance for turning work, the method of scraping and adjusting the contact surface, i.e. bed, cross slide, head stock, tail stock, and the lead shaft is changed to ball screw type guide shaft). The dimensions of ø 16 x 5 with ball nut for driving the turret axis along the lathe axis or Z-axis for cross-section or X-axis change to shaft ball screw size ø 12 x 5 with Ball nut (Ball nut), both axes are driven by a stepping motor (Stepping motor) using the Mach 3 control unit as a program for controlling the operation from the experiment with the movement of the turret platform to check the distance of moves with the check bar on both axes. It was found that in the X axis tested at a distance of 49.504 mm with 95% confidence (Confidence Interval: CI) and move back coverage to the actual distance of 49.504 mm resulted in insignificant differences, and the Z axis was tested at distances of 49.504 and 59.172 mm with 95% confidence (Confidence Interval: CI) for moving back and forth.

Research Objectives

1. To study and analyze the condition of the wood lathe.
2. To invention a semi-automatic lathe wood to be effective in processing wood products.

Research Conceptual Framework

The research team had studied information from documents, text books, concept theories, and related research results and process them into a conceptual framework as can be seen from Figure 1

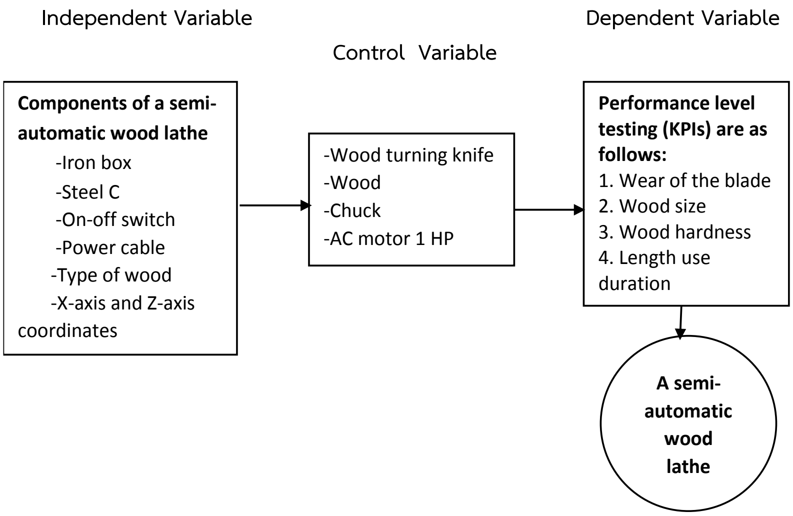

Figure 1 Research Conceptual Framework

Research methods

Data flow chart:

Step 1 Study and collect theoretical data on the lathe construction as can be seen from Figure 2.

Step 2 Design and build wood lathe base as can be seen from Figure 3.

2.1 Design a wood lathe as can be seen from Figure 4.

2.2 Build wood lathe base

2.3 Motor base design for positioning

2.4 Build motor base

2.5 Design lathe knife appearance

2.6 Build a turning knife as can be seen from Figure 5.

Step 3 Assemble wood lathe by attaching the work piece chuck and motor to the machine base and attach to the belt and turret to the wood lathe, run electrically in the lathe and check the integrity of the wood lathe as can be seen from Figure 6.

Step 4 Testing of woods, one by one from eucalyptus, acacia, mango, tamarind, and teak (as can be seen from Figure 7,8,9,10 and 11) on lathe performance to find a wooden bar to turn that the machine can actually be used without defects.

Step 5 Summarize wood lathe performance.

Step 6 Prepare research papers and disseminate research information.

Operating procedures diagram

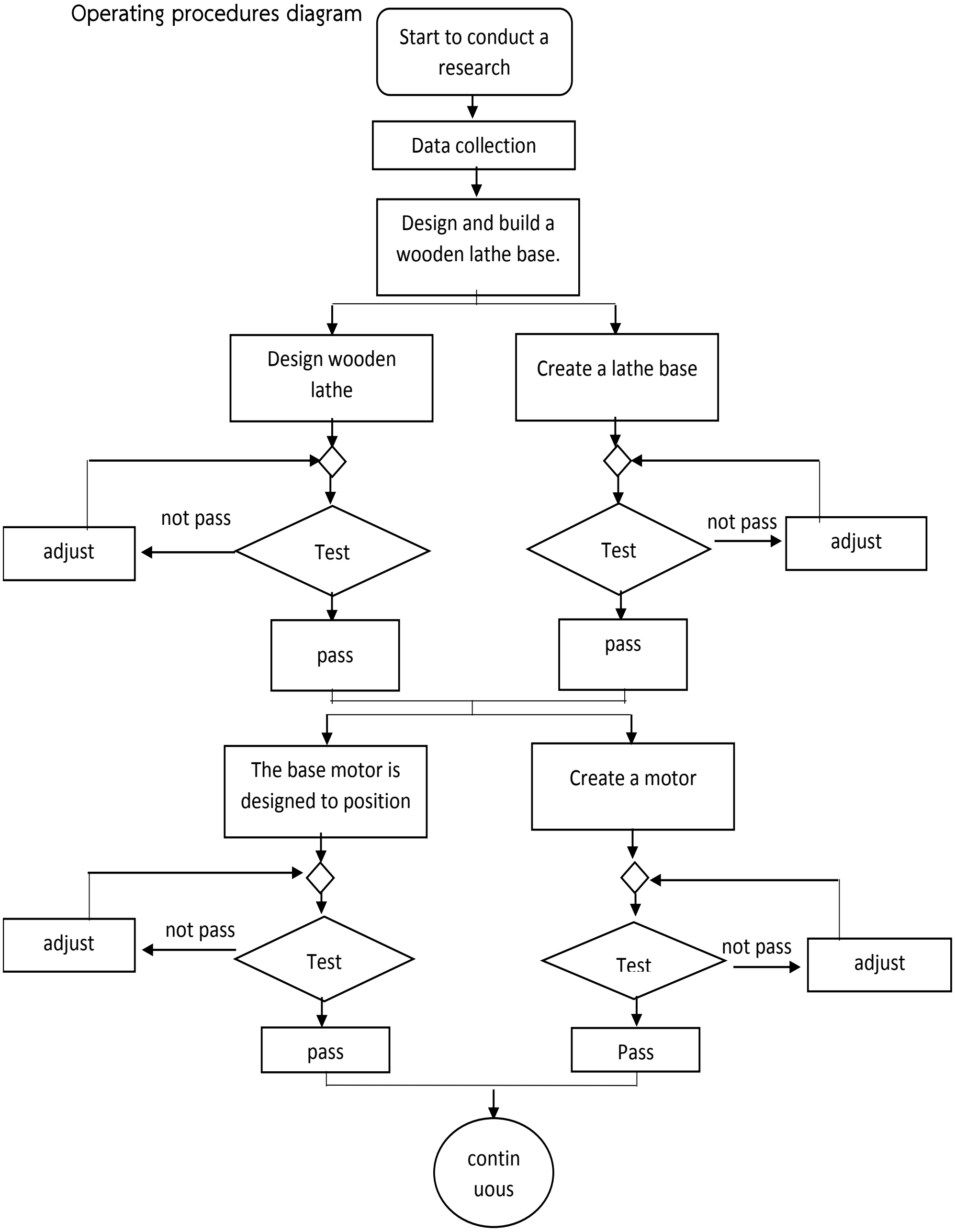

Figure 2 Operation procedure diagram

Operating procedures diagram to

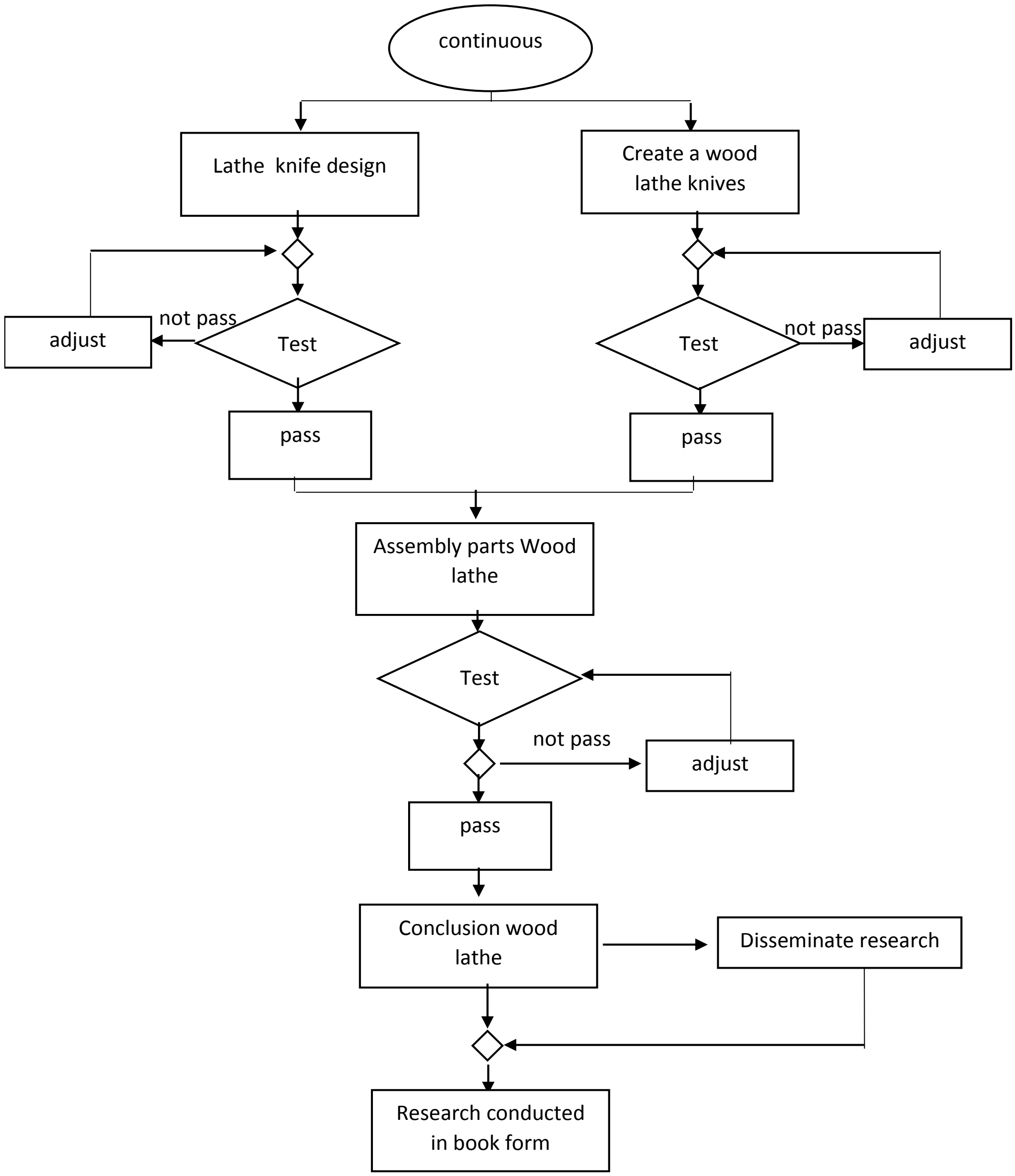

Figure 3 Operation procedure diagram (continue)

Figure 4 Semi-automatic lathe wood

Figure 7 Eucalyptus wood

Figure 5 Turning knife

Figure 8 Mango wood

Figure 6 Welding of the structure of a wood lathe

Figure 9 Acacia wood

Figure 10 Tamarind wood

Figure 11 Teak wood

Results and Discussions

The results of the 2-axis lathe experiment, the researcher controlled this experiment by determining the efficiency of the wood lathe for each wood turning, and also aimed to find the accuracy to choose the right type of wood. The researcher conducted an experiment to determine the efficiency of a 2-axis lathe which was conducted in different coordinates to study the tolerance of the X-axis coordinate and the Z-axis coordinate.

The research results are that the condition of the original wood lathe and the use of the manufacturer in the Nasom Village Community is not able to produce community products, souvenirs and furniture processed from wood. It cannot supply the demand of producing products for the distribution to the consumer markets. Moreover, the experimenting with the lathe on different types of wood, such as duration, length and depth are related to the size of the blade. The suitability of wood for both X-axis and Z-axis was tested. The wood suitable for turning from the experiment was a 35 mm. X-axis face milling cutter. The smallest wood that could be machined was a teak with a size of 22 mm. with the minimal working time of 4 minutes in Z axis size 40 mm. The shortest machined wood is teak with size 32 mm. The working time is 4 minutes and the suitable wood type is teak that is the most suitable for turning work, as shown in Table 1 below:

Table 1 Wood Type Hardness Test of X-axis coordinates and Z-axis coordinates from facing cutters.

Wood Type	Test			
	Experiment with the X-axis 35 mm	Set Time of Work	Experiment with the Z-axis 40 mm	Set Time of Work
	Workpiece size (mm)	Mintue	Workpiece size (mm)	Minute
Eucalyptus	32	4	37	4
Mango	29	4	36	4
Acacia	27	4	35	4
Tamarind	27	4	33	4
Teak	22	4	32	4

The woods used for this experiment are eucalyptus, mango, acacia, tamarind, and teak with the X-axis/Z-axis of 32/37, 29/36, 27/35, 27/33, and 22/32 respectively, within the set time of 4 minutes work for all kind of wood.

For the wear test of the wood turning knives at the X and Z axis, the results from the experiment in the X axis showed that the blade wear was different. Due to the hardness of the teak or tamarind wood, it causes different wear. For example, the soft wood as eucalyptus, acacia, or mango did not damage the knife much, and each type of wood has a different effect on the wear of the blade. From the Z-axis experiment, it was found that the blade wear test was different due to the dissimilar hardness of wood, for example, not very hard wood did not cause much damage to the blade during the wood turning operations of a semi-automatic wood lathe.

A semi-automatic wood lathe can be developed more efficiently and faster in production applications. The hardness of teak or tamarind causes different wear. For example, a not very hard wood damages the knife less, and each type of wood has a different effect on the wear of the blade. From the Z-axis experiment, it showed that the blade wear test was different because of the dissimilar hardness of the wood.

A semi-automatic wood lathe can be developed more efficiently and fater in production applications, because the hardness of the wood that is involved causes different wear. For example, a not very hard wood damages less the knife, and each type of wood has not the same effect on the wear of the blade. From the Z-axis experiment, it was found that the blade wear test was different because of the dissimilar hardness of wood, for example, not very hard wood damages the blade during wood turning operations by a semi-automatic wood lathe.

A semi-automatic wood lathe should be developed to be more efficient and faster in production applications. Mild wood will not cause much damage to the blade during the turning operation of a semi-automatic wood lathe, as shown in Table 2:

Table 2 Wear test of wood turning knife at X-axis

X-axis Wood Turning Knife Wear Test					
Wood Type	Teak	Tamarind	Acacia	Mango	Eucalyptus
Test Duration (Minute)	5	5	5	5	5
Wear of Wood Turning Knives	Stable	Stable	Stable	Not stable	Not stable

For the wear test of the wood turning knives at the X and Z axis, the results from the experiment in the X axis showed that the blade wear was different. Due to the hardness of teak or tamarind, it causes different wear. For example, the soft wood as eucalyptus, acacia, and mango did not damage the knife much, and each type of wood has a different effect on the wear of the blade. From the Z-axis experiment, it was found that the blade wear test was different due to the dissimilar hardness of wood, for example, not very hard wood did not cause much damage to the blade during the wood turning operations of a semi-automatic wood lathe.

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Table 3 Wear test of wood turning knife at Z-axis

Z-axis Wood Turning Knife Wear Test					
Wood Type	Teak	Tamarind	Acacia	Mango	Eucalyptus
Test Duration (Minute)	5	5	5	5	5
Wear of Wood Turning Knives	Stable	Stable	Not stable	Not stable	Not stable

Conclusions

The research results are as follows: 1) as the original wood lathe and the use of the manufacturer in the Nasom Village Community cannot produce wood products to supply the markets, so this invented semi-automatic lathe wood can be developed more efficiently and faster in production applications with teak and tamarind hardness that causes different wear; while acacia, mango, and eucalyptus will not cause much damage to the blade; 2) the experimenting with the lathe on different types of wood related to the blade size; 3) wood suitable for X-axis and Z-axis was a 35 mm. X-axis face milling cutter; 4) teak can provide the smallest wood from the experiment of using a 22 mm. teak wood, 4 minutes of the minimal working time, in 40 mm. Z-axis; as well as it can provide the shortest wood of 32 mm within 4 minutes, and 5) the wear test of the wood turning knives at the X-axis and Z-axis, shows that the blade wear was different due to the hardness of the wood.

Therefore, in conclusion, the overall result is that this semi-automatic lathe wood can be used in the process of producing sawn timber as a product of the Nasom Village Community including it can be developed more efficiently and faster in production applications.

Acknowledgment

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