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Making of Stamped Batik by Machined Batik Stamp Pattern Made from Hand Made Design Batik Image

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***Abstract*— The objective of this practical research is to produce salable stamped batik by low cost production, especially on the making of the batik stamp stand. The method applied are operating varies spindle speeds and cutter diameters, applying selected simplest software prior to the programmable CNC Milling Machine, and testing the resulted stamped batiks by expert judgement.**

The use of spindle speed of 4775 rpm (6 mm cutter dia.) and 8550 rpm (3 mm cutter dia.) performed normal cutter condition and fine cutting lines of the work pieces at cutting motion of 0,03 to 0,09 mm/cycle. Prior to operating the machine the use of software Vectric Aspire 4.0 can easily convert handmade batik image for the making of tool paths. Based on practical purposes of the resulted batik stamped is stated that these stamped batiks are salable.

Keywords— stamped batik, machined batik stamp pattern

I. INTRODUCTION

There are two traditional type of batiks, first called There are two traditional type of batiks, first called as 'batik tulis' (written batik), and the second called as 'batik cap' (stamped batik). The written batik is drawn using only the *canting*. The cloth need to be drawn on both sides and dipped in a dye bath three to four times, while the stamped batik is stamped serially to produce the patterns. Process to make the written batik may take up to a year, and it results considerably finer patterns than stamped batik. The stamped batik is considerably used by most people as its low cost compared with the written batik. The quality of the stamped batik primarily depend on the quality of batik stamp stand (BSS). BSS is a handy craft work fully worked by hands of expert of batik. Traditionally BSS is made of the forming of copper plate of 0,25 mm in thick and 20 mm in width to form patterns. The craftsmen are now limited and most of them are old man, but they have high capability to drawn the patterns by hand before making it as BSS. The time to make BSS may take up to 2 weeks.

The factors that affect CNC advantages compared to conventional machine tools are: not many settings, the tool moves automatically according to the requested program, operating chuck driven by chuck wear hydraulics or pneumatics, movements of cutters can be monitored on the computer screen, a smallest error rate, and time efficiency. Because of such advantages, since 1975 the production of CNC machine began to grow rapidly. This development was driven by the development of the microprocessor, so the volume control unit can be more concise [1].

Suharto [2] developed the application of CNC Milling especially for machining the *batik* pattern. The CNC milling application can be alternatively operated to make machined batik pattern instead of handmade batik pattern (Fig.1). To design pattern engraved on the material of stamp need the following steps: (1) pattern design of batik may be taken from (a) image or (b) being made by any engineering software (Corel Draw, auto cad, solid work). (2) pattern design made of engineering software is saved into format of DXF AutoCAD (*.dxf) provided by master cam software. (3) After having G-code from master cam software the G-code data is entered to Mach 3 software installed in the CNC milling machine computer. Transferring process G-code data to the machine computer can be done by installing a flashrdisk onto USB port.(4) Start operation of the machine, make sure all electric connections is on, then open Mach 3 software by which the movement of the milling cutter will function. Meanwhile, Suryanto [3] showed that the use of aluminum plate is economically better instead of copper plate as inserted batik patterns of BSS

Figure 1. Making of hand made batik patterns (left) and machined batik pattern (right)

Research by Setyono [4] showed that the high-speed spindle, will generate the value of the smaller surface roughness, the higher rate of feeds, will result in surface roughness values greater and the higher the depth of feeds, will generate value greater surface roughness. Experiments concerning variation of feeding rotational speeds has previously been carried out by Ninuk Jonoadji and Joni Dewanto [5], using S45C steel as work piece at rotational speeds 50 to 4500 rpm, whilst other researchers [6] using work piece of ST 37 steel at feeding rotational speeds of 440, 560 and 740 rpm and with feeding of 0.098; 0.112; and 0.168 mm / rev respectively. Based on these research installation of high speed spindle is necessary to get fine cutting edge of machined stamped batik.

The batik patterns resulted by the CNC milling of low speed of spindle is not capable of forming lines and curves of fine batik images. The such fine batik images need higher speed of spindle and small diameter of cutters. The objectives of this applied research are: 1) to modify the spindle speed of the CNC milling machine; 2) to form lines and curves of fine batik images on alumunum plate; and 3) to test the resulted stamped batiks. Some experiments showed that result of machining processed influenced by factors of spindle speed and feed rates.

II. METHOD

In line with objectives of this applied research, the following practical methods are realized: (1) installing high speed spindle and small diameter cutter; (2) applying selected engineering software directly from the images of 4 (four) fines batiks; and (3) testing the resulted stamped batiks is scored by expert judgement.

1) Installing high speed spindle and small diameter

Installing high speed spindle on the new CNC Milling is designed for enabling to run small diameter cutter at the selected spindle speed ranges of 4500 rpm to 10.000 rpm of 4775 rpm, to run cutters of 3 to 6 mm in diameter. It will show the cutting performances of cutter condition and cutting lines on the aluminum plate to be machined.

2) Application of engineering selected software

The application of selected engineering software directly from the images of 4 (four) fines batiks. The selected software is the simplest one and easy to be applied prior to be used in the CNC Milling Machine.

3) Testing the resulted stamped batiks

To test the stamped batik resulted, stamping process was done by expert of stamped batik located in Semarang, Central Java Province. All preparing steps are realized by the expert. The testing based on practical purposes of the resulted batik stamped as salable or not salable compared with the existing batik stamped generally.

III. RESULT AND DISCUSSION

A. Installing High Speed Spindle and Small Diameter

Installing high speed spindle and small diameter cutter onto the new CNC Milling machine with the following specifications: Frame: steel, finishing with powder coating; Machine dimension: 1540 x 1005 x 150 mm; working area/travel: 600 mm x 400 mm x 150 mm; spindle motor: 3 KW, 18000 rpm, air cooled; axis drive: stepper motor (X: 8.7 Nm, Y: 8.7 Nm, and Z: 7.7 Nm)' Resolution: 0.01 mm; Power: AC 220 V/50Hz/3.5 KW; Computer: Dualcore, 2GB RAM, 15" Touch screen LCD Monitor; Software: Mach 3 CNC control.

The speed of spindles are selected 4500 rpm to 10.000 rpm of 4775 rpm, to run cutters of 3 to 6 mm in diameter. The result of operating the new design CNC Milling machine to make fine batik patterns are presented in Table 1 and Table 2.

It was shown that the use of spindle speed of 4775 rpm, cutter diameter of 6 mm performed normal cutter condition and fine cutting lines of the work pieces at cutting motion of 0.03 to 0.09 mm/cycle. Meanwhile, the use of spindle speed of 8550 rpm, cutter diameter of 3 mm performed in normal condition and fine cutting lines of the work pieces at cutting motion of 0.03 to 0.06 mm/cycle.

B. Testing the Resulted Stamped Batiks

To test the stamped batik resulted, stamping process was done by expert of stamped batik located in Semarang, Central Java Province. The following steps are realized by the expert accordingly:

1. Preparation of tools and materials and process of stamping: a) Tools used are stove, small pan, burlap, superfine cotton cloth, flat table, wax grader, dye bath,

wooden rod cylinder, drum water container; [b)] Materials needed include wax bars, superfine cotton cloth, batik stamp stand (aluminium), water, detergents and dyes; [c)] Place the pan on the stove for heating, then boiled the wax bar in the pan until melted and keep the small fire lit to keep the temperature of the liquid wax stays at 60-70 °C; [d)] Heat the batik stamp stand by putting it into a liquid that has been covered by burlap for a while and make sure the batik stamp stand is immersed ± 2cm. It is intended that the wax liquid can be attached to the batik stamp stand strongly. While waiting the batik stamp stand heated, prepare superfine cotton cloth and place it on a flat table that has been coated with a soft material underneath; [e)] Remove the batik stamp stand from the heating pan, then stamped on the cloth that had been prepared earlier with a given pressure to penetrate the wax into the pores of the fabric prism through to the other side surface of which the batik image can be formed perfectly

2. Process of coloring: [a)] Select the color to be used then mixing dyes with a certain composition in a dye bath that had been prepared; [b)] Dip a cloth which had been stamped into the dye bath until at about 5 times to maximize the color can penetrate into the pores of the fabric. Then drain cloth on a wooden rod cylinder that has been placed over the bath; [c)] Rinse the cloth that had been colored by dipping into a bath containing water; [d)] Insert the fabric into a drum filled with water that has been heated on the stove. This process aims to fade wax attached to the fabric, so that it will form two colors namely basic fabric-covered wax and color resulting from the coloring process that had not been closed by the wax; [e)] Rinse the cloth that has been boiled using clean water, dip a several times until it looks clean, then drain.
3. Process of drying: Place the fabrics under directsunlight to dry.

The aforementioned steps done by batik expert at Semarang, using 4 hand made of batik images by applying 4 batik stamp stands each respectively, and resulted 4 batik fabrics as shown in Table 3 and Figure 2.

TABLE I. PERFORMANCE OF CUTTING : SPINDLE SPEED OF 4775 RPM & CUTTER DIA. OF 6 MM

Cutting motion (a) mm/cycle	Feed rate = mm/men	Performance				
		Cutter condition			Cutting lines	
		broken	blunt	normal	coarse	fine
0.15	716.25	v			v	
0.12	716.25		v		v	
0.09	429.75			v		v
0.06	286.50			v		v
0.03	143.25			v		v

Source: Setyadi, 2015 (processed)

TABLE II. PERFORMANCE OF CUTTING : SPINDLE SPEED OF 9550 RPM & CUTTER DIA. OF 3 MM

Cutting motion (a) mm/cycle	Feed rate = mm/men	Performance				
		Cutter condition			Cutting lines	
		broken	blunt	normal	coarse	fine
0.15	1432.5	v			v	
0.12	1146	v			v	
0.09	859.5		v		v	
0.06	573			v		v
0.03	286.5			v		v

Source: Setyadi, 2015 (processed)

Figure 2. The hand made of batik images (below), the machined batik stamps (middle) and the resulted fabric batiks (top)

TABLE III. ASSESSMENT OF THE FOUR FABRIC OF BATIKS BY THE EXPERT

Nr. of Batik Stamp Stand	Elements of Assessment				Average Scores
	Image of batik	Quality of stamping	Harmony of coloring	Penetration of wax to the fabric	
01	2	4	4	2	3
02	3	4	4	4	3,75
03	4	4	4	4	4
04	4	3	4	4	3,75

Source: Setyadi, 2015 (processed)

Scoring for the each elements of assessment are 1 (very bad); 2 (bad); 3 (good); and 4 (very good) done by an expert of batik (Sanggar Batik Semarang). Each of resulted batik fabrics has been scored of 3 and more. These results indicate that the resulted batik fabrics are salable as well.

IV. CONCLUSSION

The use of spindle speed of 4775 rpm, cutter diameter of 6 mm performed normal cutter condition and fine cutting lines of the work pieces at cutting motion of 0,03 to 0,09 mm/cycle. Meanwhile, the use of spindle speed of 8550 rpm, cutter diameter of 3 mm performed normal cutter condition and fine cutting lines of the work pieces at cutting motion of 0,03 to 0,06 mm/cycle. Both operation measures are applied to make batik image on aluminum plate by operating the aforementioned CNC Milling machine. Prior to operating the machine the use of software Vectric Aspire 4.0 can easily convert hand made batik image for the making of *tool paths*. The use of Corel Draw, as done by Barkati [8], is less practical compared with the application of Vectric Aspire 4.0 for converting the batik image directly prior to applying software Master cam and Mach 3 respectively.

Based on judgement expert method, each of resulted fabric batik has score of 3 and more. These results indicate that the resulted batik fabrics are salable as well.

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