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The Effect of Roller Mass Variation on the CVT System on the Torque of a 110 CC Motorcycle

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ABSTRACT: Nowadays, automatic motorcycles are more popular because they are easier to use by the public, male or female, young or old. One of the things that distinguishes automatic motorcycles from manual motorcycles is the transmission system used. Automatic motorcycles use a CVT transmission type where the roller masses used vary. So it is necessary to study whether the roller mass affects the work of the CVT. The purpose of this study was to determine the effect of variations in roller mass on the CVT (Continuously Variable Transmission) system on the torque of a 110 cc motorcycle. Experimental methods were used in this study. This study used various variations of different roller masses, namely 8 gram, 10 gram, 12 gram (standard) and 14 gram rollers. Testing was carried out using an inertia dynamometer to determine the torque value. The results of the study using an 8 gram roller obtained the highest torque value with a value of 7.30 Nm at 8000 rpm. While the lowest torque value was obtained using a 14 gram roller mass variation, namely 5.83 Nm at 8000 rpm.
KEYWORDS: Roller, CVT, Torque, Transmission System.

I. INTRODUCTION

Nowadays, automatic motorcycles are more popular because they are easier to use by the public, male or female, young or old. And the price is relatively cheaper compared to other types of motorcycles, making automatic motorcycles increasingly popular [1]. What distinguishes automatic motorcycles from other types of motorcycles is the transmission system used. The transmission system in question is an automatic transmission system. This system can be defined as a vehicle transmission that is operated automatically by utilizing centrifugal force or often referred to as Continously Variable Transmission (CVT). CVT is a power transmission system from the engine to the rear wheels using a belt (V-belt) that utilizes friction on the belt (V-belt) that connects the drive pulley to the driven pulley [2]. CVT is one of the innovations in the automotive industry. Where this CVT system has a practical advantage, namely that it has been designed automatically so that there is no need to operate the gear shift lever when increasing or decreasing speed, simply by playing the gas slop connected to the throttle. CVT makes it easier for riders to drive motorbikes because it is easier to control the vehicle. This system makes it unnecessary for riders to change the transmission ratio through a special lever because this system changes it automatically. However, automatic motorcycles with automatic transmissions also still have weaknesses in performance, as evidenced by the decrease in speed. This decrease is caused by automatic motorcycles that use automatic gear shifters, where for standard automatic transmission systems, the maximum engine speed cannot be channeled to the transmission system to the maximum, so that it cannot increase vehicle speed. Unlike manual transmission motorcycles, speed can be optimized when shifting gears [3]. The roller is one of the important components in the automatic transmission system or CVT. Variations in roller mass will greatly affect the performance of the automatic transmission system, so that it can reduce weaknesses in automatic motorcycles. The heavier the roller, the more optimal the ability to move to push the movable drive face on the drive pulley so that it can press the belt to the maximum. This means that the heavier the roller, the more it will increase the middle and upper power to be more

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maximum, and vice versa if the roller is too light, it cannot press the belt to the maximum, the effect is that the middle and upper power will be reduced [4]. The average highest speed is 128.2 km/h on a roller weighing 11 grams, while the lowest average speed value is 125 km/h on a roller weighing 13 grams. And for the highest average rpm is 9100 rpm on a roller weighing 12 grams, while the lowest average rpm value is 8942.67 poda roller weighing 13 grams. While for the highest average power is 11.37 HP on a roller weighing 11 grams and the lowest average power value is 11.02 HP on a roller weighing 13 grams [5].

Research using v-belt variation 1 obtained the highest power and torque by the 8 gram roller of 9.93 HP, for the 10 gram roller of 9.16 HP, while the 12 gram roller was 8.36 HP at 3500 rpm. The highest torque by the 8 gram roller reached 25.05 Nm, for the 10 gram roller it reached 27.67 Nm, while the 12 gram roller reached 26.19 Nm at 1500 rpm. The highest power and torque using v-belt variation 2 was produced by the 8 gram roller of 9.7 HP, for the 10 gram roller of 9.23 HP, while the 12 gram roller was 9 HP at 5500 rpm. The highest torque of the 8 gram roller reached 25.9 Nm, for the 10 gram roller it reached 23.41 Nm, while the 12 gram roller reached 24.31 Nm [6]. The use of automatic transmission type (CVT) concluded that the torque and power of the motor engine increased the most when using a 13 gram roller. The highest engine speed is 7000 rpm, torque 3.2 Nm and Power 2.34 kW. Meanwhile, fuel savings and efficiency are higher when using lighter rollers, namely 10.5 gram and 7 gram rollers [7]. The weight of the roller has an effect on changes in the performance of the 150 cc Vario motorbike engine. The use of a 13 gram roller, gets the best power results of 10.23 HP at 5000 rpm and the best torque of 10.49 Nm at 4000 rpm and produces the best speed of 119.68 km / h. When using a roller weight of 15 grams and 18 grams there is a decrease in power obtained, namely 9.45 HP and 9.57 HP at 4000 and 6,000 rpm. The best torque is obtained at 4000 rpm with a roller weight of 18 grams of 10.65 Nm, and the 15 gram roller produces a decreased torque of 10.59 Nm at 4000 rpm, while the use of roller weights of 15 grams and 18 grams for maximum speed results is 122.87 km/h at 4000 rpm, while the 18 gram roller has a decrease in speed so that the maximum speed is 120.34 km/h [8].

II. RESEARCH METHODS

This study uses an experimental method, namely conducting research and testing directly on the research object.

Research Variables

The variables in this study are:

1. Independent variables

The independent variables are variables that are freely determined by the researcher and will affect the dependent variables. The independent variables in this study are the effect of variations in roller mass of 8 grams, 10 grams, 12 grams (factory standard) and 14 grams on the CVT system on the performance of a 110 cc motorcycle.

2. Dependent variables

The dependent variables are variables that are the main focus in carrying out the research. The dependent variables in this study are the effect of variations in roller mass on the CVT system on the torque of a 110 cc motorcycle.

Testing Procedure

The steps taken during testing are as follows:

a. Trying the engine to operate for 4-5 minutes before testing. This is done to achieve the ideal working temperature of the engine after changing or before changing the roller.
b. Preparing the tools and materials that will be needed during testing.
c. Preparing the motorcycle on the dynamometer and installing the safety belt on the motorcycle.
d. Prepare the parts of the dynamometer tool needed during testing.
e. After the dynamometer tool is ready and the motorcycle is turned on.
f. Then testing is carried out from idle rpm to maximum engine speed with the specified roller mass.
g. Data collection, recording the data listed on the dynamometer tool monitor, namely motorcycle torque.
h. After the test is complete using the first roller mass, let the engine stand for 4-5 minutes. This is done to cool the engine and make it easier to dismantle it to continue testing with the second roller mass.
i. Repeat steps b to i with different roller masses.

III. RESULTS AND DISCUSSION

Torque is a good parameter in determining the performance of a machine which is defined as the force acting at a distance for a moment with units (Nm). Torque indicates how much power is

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produced [9]. Torque testing in this study was carried out on an inertia dynamometer by varying the roller mass, namely 8 grams, 10 grams, 12 grams (factory standard) and 14 grams.

The results of this test can be seen that the torque value for using variations in roller mass of 10 grams, 12 grams (factory standard) and 14 grams is almost the same at the same engine speed, while for a roller with a mass of 8 grams it has the highest torque value among the other variations. This is because the mass of the 8 gram roller has the lightest mass among the other rollers. Therefore, the ability of the roller to change the transmission ratio is slower so that the torque value obtained is the highest at the same engine speed among the other variations. While for the mass of the 14 gram roller, the ability of the roller to change the ratio on the primary pulley is faster and presses the v-belt to the largest diameter position, so that the torque value is lower than the torque value of the 8 gram roller.

Based on Figure 1, the torque generated by the engine increases directly with the increase in engine speed, it can be seen that for each variation of the roller mass used, the torque value will continue to increase until the engine speed is 7000 to 8000 rpm. This is because the torque value generated through fuel combustion increases, because the amount of fuel entering the combustion chamber increases along with the increase in engine speed. However, it is different if the maximum torque has been achieved based on the graph above, the torque value will decrease, this is due to the characteristics of the combustion air flow, at high speeds, the engine requires more air and fuel to achieve efficient combustion. If the air or fuel supply is limited, this can result in a decrease in the torque value. The torque value decreases also due to increased friction, when the engine speed increases, friction losses in the engine also increase. In addition, engine components experience more friction that must be overcome at high speeds so that it can affect the output torque value.

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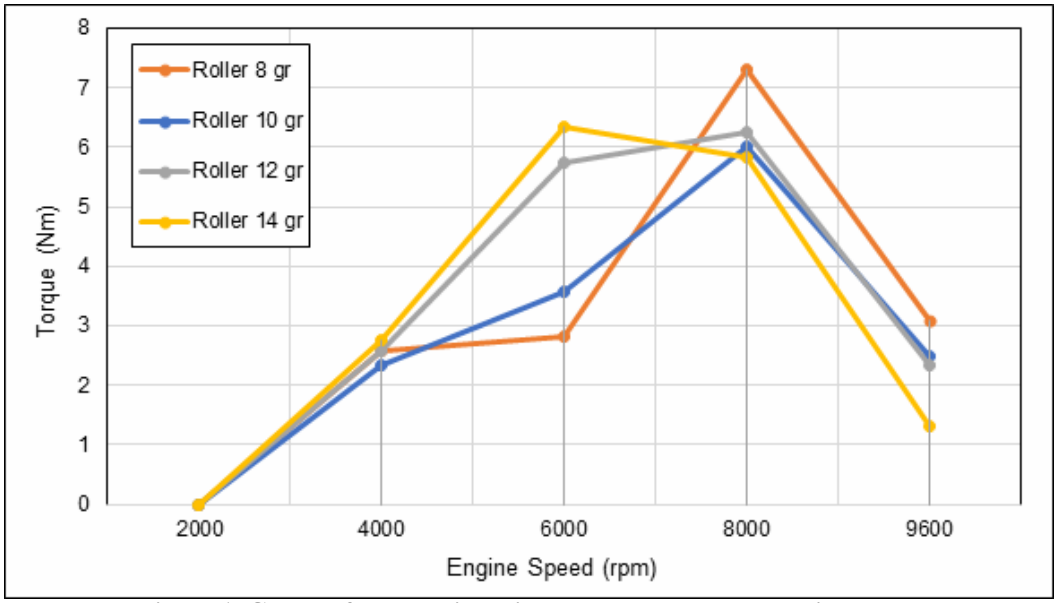

Figure 1. Graph of the relationship between torque and engine speed

IV.

It can be seen that the variation of roller mass affects the torque value produced. The largest torque value is produced by using an 8 gram roller, namely at an engine speed of 8000 rpm, producing a torque value of 7.30 Nm greater than using a 10 gram, 12 gram (factory standard), and 14 gram roller. This is because the use of an 8 gram roller at an engine speed of 8000 rpm can be seen in the picture above, a roller with a mass of 8 grams has the lightest weight, so that the roller can be thrown faster and push the sliding sheave/roller housing and maintain the movement of the roller pressing the v-belt, so that the torque transmitted from the engine is channeled to the wheels more optimally. The use of an 8 gram roller gets the highest torque with a range of 7.11-7.37 Nm at an engine speed of 8000 rpm, so the average torque value obtained by using a variation of the 8 gram roller mass is 7.30 Nm. While the use of a 12 gram roller (factory standard) gets the highest torque value with a range of 6.25-6.25 Nm at 8000 rpm, the average torque value obtained is 6.25 Nm. This shows that there is an increase in torque value by using an 8 gram roller from using a 12 gram roller (factory standard) with an increase of 14%. Using a 10 gram roller gets the highest torque with a range of 5.75-6.25 Nm at 8000 rpm, the average torque value obtained is 6.00 Nm. Using a 14 gram roller gets the highest torque with a range of 5.5-6.25 Nm at 8000 rpm, the average torque value obtained is 5.83 Nm. While using a 12 gram roller (factory standard) gets the highest torque value with a range of 6.25-6.25 Nm at 8000 rpm, the average torque value obtained is 6.25 Nm. This shows that there is a decrease in torque value using 10 gram and 14 gram rollers from using 12 gram rollers (factory standard) with a decrease of 4% and 6.7% respectively (figure 2). The highest torque value was obtained using a variation of 8 gram roller mass, which is 7.30 Nm at an engine speed of 8000 rpm. This shows that using an 8 gram roller has the ability to be thrown faster and push the sliding sheave/roller housing and maintain the movement of the roller in the position of pressing the v-belt so that the torque transmitted from the engine is channeled to the wheels more optimally. While the lowest torque value was obtained using a variation of 14 gram roller mass, which is 5.83 Nm at 8000 rpm. This shows that the ability of the roller is thrown slower but faster to push the sliding sheave/roller housing but is unable to maintain the movement of the roller in the position of pressing the v-belt, so that the torque transmitted from the engine is channeled to the wheels less than optimally. This is also supported by research [10].

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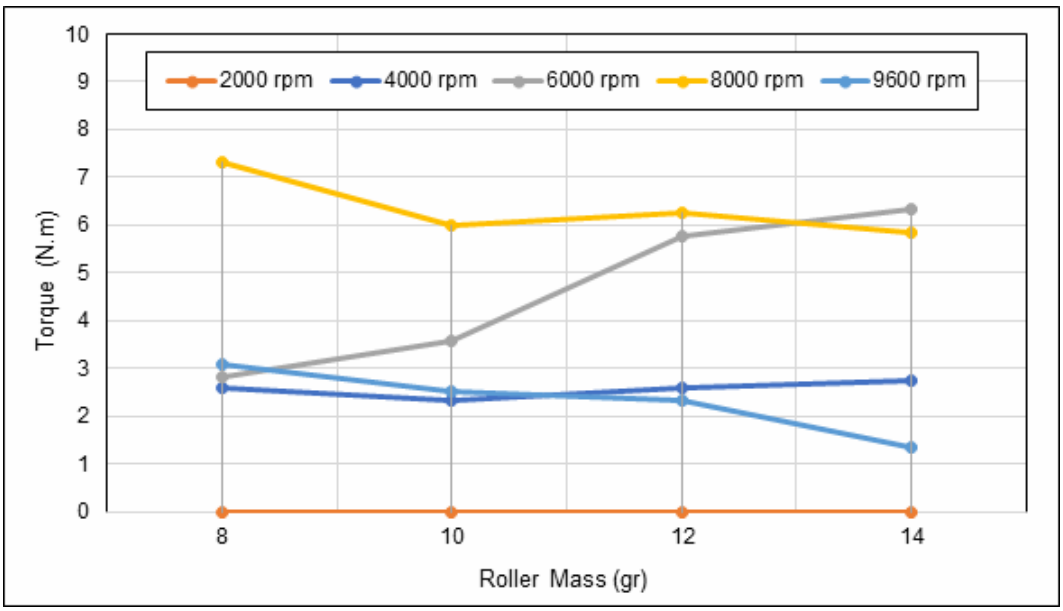

Figure 2. Graph of the relationship between torque and roller mass

V. CONCLUSION

Based on the results of the analysis and discussion of the research on the effect of using variations in roller mass on the CVT (continuously variable transmission) system on the torque of a 110 CC motorcycle. In this study, tests have been carried out on variations in roller mass changes in the CVT system, namely sizes 8 grams, 10 grams, 12 grams (factory standard), and 14 grams. Varying the roller mass will affect the torque on the motorcycle. The highest torque value is obtained by using a variation of the roller mass of 8 grams, namely 7.30 Nm at an engine speed of 8000 rpm and the lowest torque value is obtained by using a variation of the roller mass of 14 grams, namely 5.83 Nm at an engine speed of 8000 rpm.

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