

Pneumatic gear shifter analysis

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ABSTRACT - Conventional design of transmission gear shifter is basically consists of mechanical linkage of gear lever attached on the side of motorcycle engine with pivot directly connected to the gear shifting mechanism. Shifting up and down of gear positions are performed by moving foot or toe upward and downward on the lever respectively. For disable rider (rider requires special need), shifting gear for manual transmission type of motorcycle with or without clutch system is difficult. In this research, a pneumatic gear shifter is designed and tested. It consists of pneumatic circuit with actuator, tanks and air compressor. The movement of gear lever is performed by the pneumatic actuator. Pneumatic tanks are installed to achieve optimum pressure. It also controlled by wireless system for convenient purpose and buttons installed at the handle. Simple experiment is performed to measure the force for each gear position.

1. INTRODUCTION

The transmission of a light vehicle is determined by the number of force applied to the gearshift. Most motorcycle gearshift assemblies in recent years have been fabricated with a foot pedal that is shifted upwardly and downwardly by the bottom and top surfaces of the toe or foot. In transmission system, conventionally, it has a mechanical linkage that connects the gear lever to the gear switching mechanism. The mechanism for gear changing of the transmission still remains the same that is the reliance towards the gear lever situated on the left leg of the rider [1]. The transmission system size, weight and type are varied from one manufacturer to another. Nevertheless, its basic principle on how the system works remain constant although it is produced by different manufacturers. For the simplest form of this system, it will only contain a centrifugal clutch attached to the crankshaft and then redirected to the sprocket via chain. As the engine speed increases, the clutch activates and propels the rear wheel [2][3]. A solenoid gear shifter or an electric solenoid shifter is an invention that is equipped onto motorcycle or car for the gear changing process [4]. Solenoid gear shifting mechanism uses magnet to move upwardly and downwardly [5]. This movement depends on the magnetic field that is produce by the magnet when power is supply through it.

In this research, a gear shifter test rig is designed

and used to analyze the forces required for shifting up and down in pneumatic gear shifter demo set.

2. METHODOLOGY

A gear shifter jig is developed to measure the forces required to shift the gear. Since the jig will be used for the testing of a pneumatic actuator; it will be made from plywood with thickness of 15 mm. Figure 1 shows the design of the test rig. Figure 2 shows the pneumatic gear shifter demo set. The forces are measured and recorded for analysis.

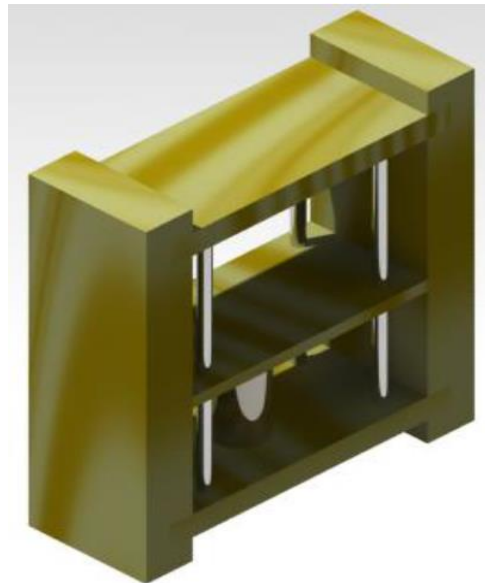


Figure 1 Gear shifter test rig design

3. RESULT AND DISCUSSION

Figure 3 to 6 show force (in kg) graph for the data of the 1st to 4th gear shifting (blue, ◆ = shift up from current gear, red, ■ = shift down from current gear). The average value of mass needed for engaging and disengaging is around 6 kg and 4 kg respectively. The amount of force required to be exerted by the riders depend on the speed of his leg; experiment result as tabulated in Table 1 shows the trend of force required for shifting on a light vehicle which is Honda Wave 110. The engagement and disengagement of gear n mean shifting from gear $n-1$ to gear n or from gear $n+1$ to gear n . From the table, it can be seen that based on all 20

data taken for each gear shifting, the amount of force required remain in the range of 45 N to 55 N.

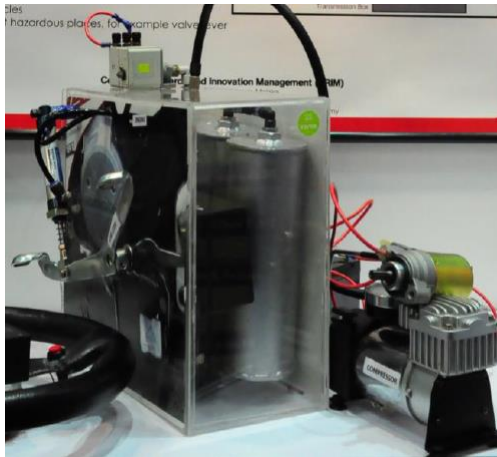


Figure 2 Pneumatic gear shifter

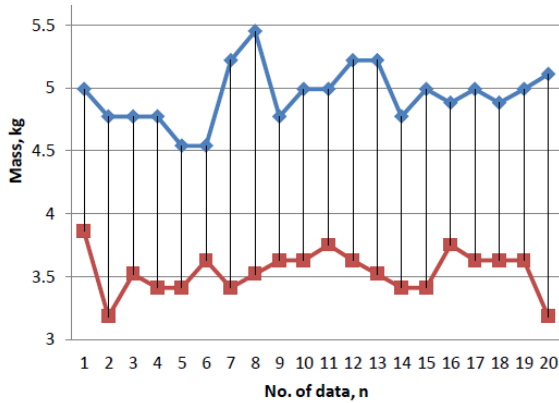


Figure 3 1st gear forces

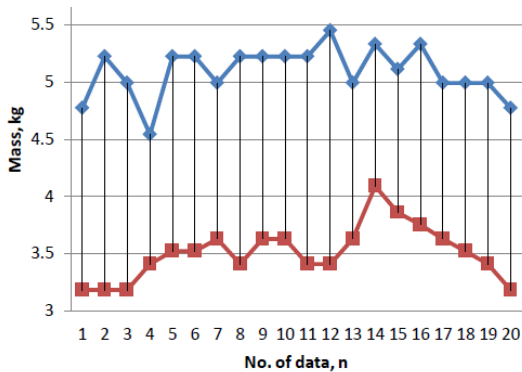


Figure 4 2nd gear forces

4. CONCLUSIONS

The analysis of wireless pneumatic gear changer has been performed. The test rig has proven experimentally produced suitable amount of force and pressure to engage and disengage gears using pneumatic actuator on the gear lever. The pneumatic gear shifter prototype is available for future improvement and installation on actual motorcycle.

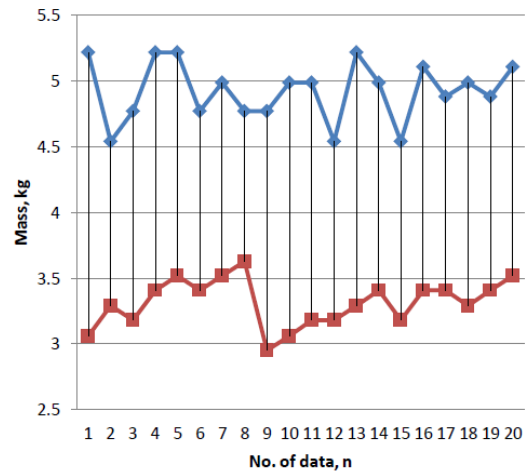


Figure 5 3rd gear forces

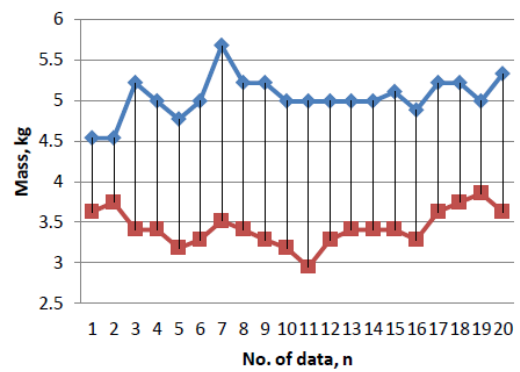


Figure 6 4th gear forces

5. ACKNOWLEDGEMENT

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