UTM UNIVERSITI TEKNOLOGI MALAYSIA | MALAYSIA-JAPAN INTERNATIONAL INSTITUTE OF TECHNOLOGY

MPE Open Ended Laboratory Sheet for Mechanics of Machines Lab

1.0 TITLE

Gear efficiency

2.0 OBJECTIVES

The objectives of this experiment are

1) To understand the speed ratio and directions of simple and compound gear trains.

3.0 THEORY

Gear - is a toothed wheel designed to transmit torque to another gear or toothed component. The teeths/cogs of a gear are shaped to minimize wear, vibraton and noise, and to maximize the efficiency of power transmission. **Torque –** the concept of torque in physics also called moment or couple. It also can be thought of a "rotational force". One can define torque as the cross product:

$T = r \times F$

Where;

r = vector from the axis of rotation to the point on which the force is acting.
F = the vector of force

A series of intermeshing gears is called **gear train** and in gear train we have a gear known as the **driver** (gear that has the force or motion input) and one known as the follower (gear that results in the force or motion output). The load comes from torque of the gear. The bigger gear has more torque than the smaller gear. Number of teeth is proportional to gear's radius, so we can calculate gear ratio;

Gear ratio = number of teeth of following gear/number of teeth of driving gear

By using the gear ratio, one can calculate the force applied on both sides as the force is proportional to the teeth of the gears.
Weight ratio = gear ratio
Force on follower/force on driver = teeth on follower/ teeth on driver

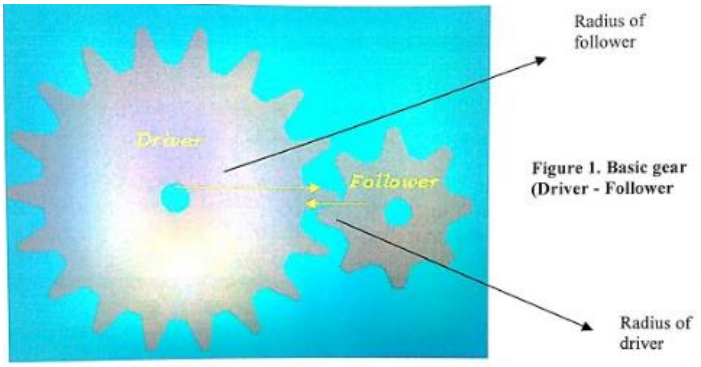

Figure 1. Basic gear (Driver - Follower

The gear ratio of a gear train is the number of teeth on the follower divided by the number of teeth on the driver. For example in the above figure, the driver have 18 teeth and the follower has 8 teeth. So the gear ratio is 8/18 or 4/9. For every 4 turns of the driver the follower turns 9 times. The velocity ratio of a gear train is also called the **gear ratio.**

The velocity of ratio:

$$V_r = \frac{Distance\ moved\ by\ effort}{Distance\ moved\ by\ load} = \frac{n_d}{n_D}$$

4.0 GENERAL EQUIPMENT DESCRIPTION

4.1 Unit Gear efficiency equipment

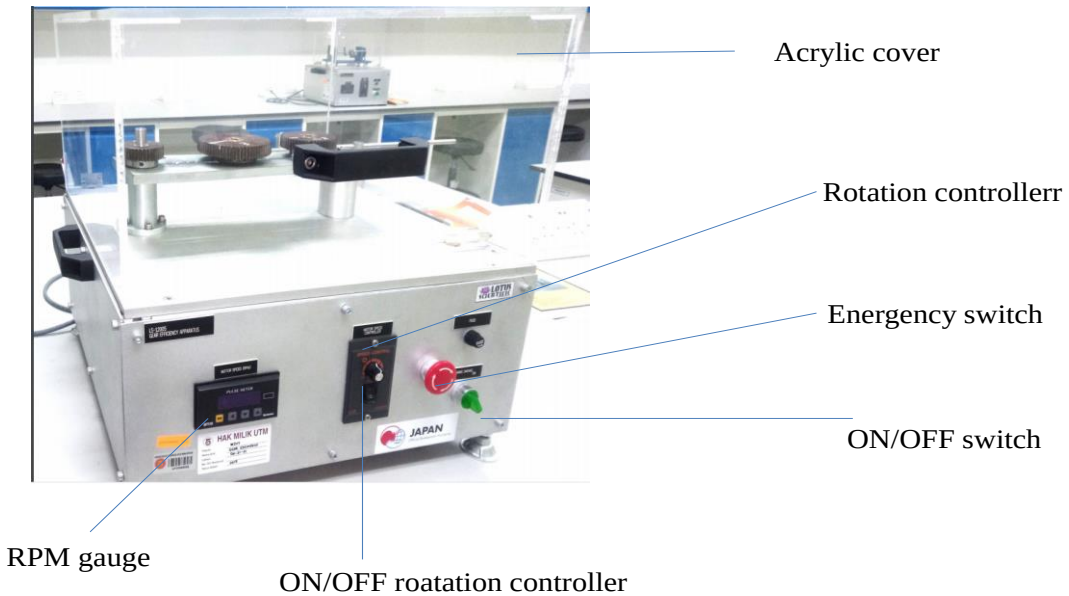

Figure 2: Gear efficiency apparatus

5.0 EQUIPMENT OPERATING PROCEDE

5.1 General Start-up Procedure before starting experiment

Before conducting any experiment, it is necessary to do the following checking to avoid any misused and malfunction of equipment.

1. Make sure that all components must fix accordingly.
2. Make sure that all current supply is in fully OFF position.
3. Make sure acrylic cover, must be used before the supply switch ON position.
4. Make sure the rotating control in OFF position before switch on the supply.

IMPORTANT:

1. Student should never allow operating devices alone without supervised by lecturer/ Technician/ lab officer/ teaching assistance.
2. The student should always be alert to experimental procedures which may be a hazard to the operator or to be injurious to the equipment.
3. Every control device and switch has a specific operational application. Be certain that all connections and control settings are carefully managed No setting should be made indiscriminately.
4. 3. Students performing the experiments should be supervised by lecturer/ Technician/ lab officer/ teaching assistance.

6.0 EXPERIMENT

Design the experiments in order to meet the given objectives.

7.0 RESULTS AND DISCUSSION

Show the results appropriately in the form of table, graph or others. Conduct the appropriate analysis and discuss the finding.

Data taken from the experiment need to be stamped by lab officer.

8.0 REPORT

Submit the FORMAL REPORT within 7 days from this experiment. Report must be typed. Similarity test will be conducted using Turnitin where similarity index of 20% is considered passing mark. Formal report must contain the following standard content:

1. Title
2. Objective
3. Introduction and Theory
4. Apparatus
5. Procedures
6. Data and results
7. Analysis and discussion
8. Conclusion
9. References

Refer to course information for the distribution of marks.