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

MPE Open Ended Laboratory Sheet for Mechanics of Machines Lab

1.0 TITLE

Centrifugal force Experiment

2.0 OBJECTIVES

The objectives of this experiment are

1. To determine the relationship between centrifugal force and speed of the masses
2. To determine the relationship between centrifugal force and distance of the masses from the axis of rotation.
3. To determine the relationship between centrifugal force and the mass of the rotating body the characteristic curve of a centrifugal pump

3.0 THEORY

3.1 Centrifugal force

Centrifugal force is a term which may refer to two different forces which are related to bodies in a rotational motion. Both of these forces are directed away from the axis of rotation, but their differences lies in the object on which the force is exerted.

Suppose a particle P of mass m and weight W moves in a circular path of radius r about a fixed centre O, as shown in Figure 1(a). The angular velocity and acceleration of OP at displacement θ from OX are ω (rads/s) and α=dω/dt (rads/s^2) respectively.

Centripetal acceleration of P towards O = $r\omega^2$

Transverse acceleration of P perpendicular to OP = rα

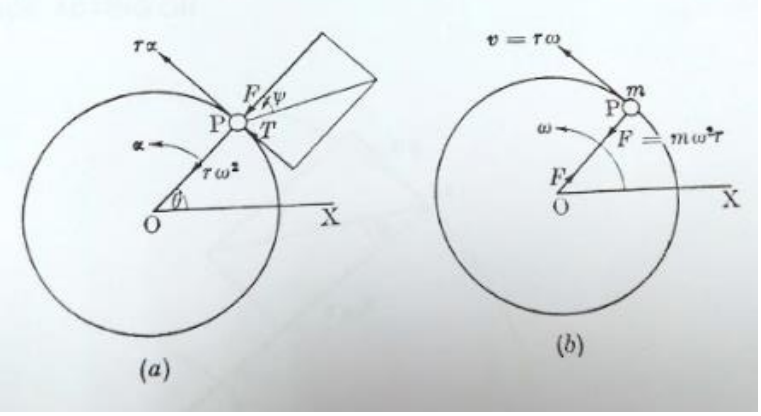


Figure 1: (a) Velocity diagram of rotating mass P; (b) Free body diagram of rotating mass P

If these accelerations are produced by external forces F and T respectively, the equations of motion become,

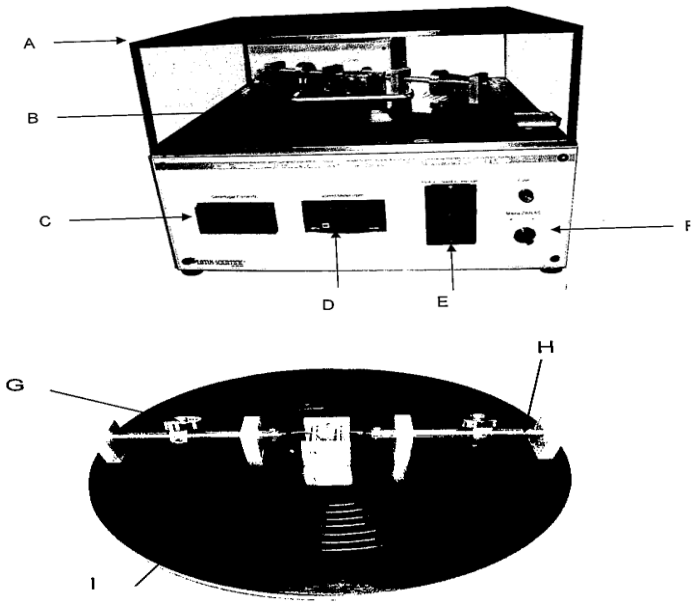
$F=m\omega^2 r=W/g \times \omega^2 r$

$T=mr\alpha=W/g \times r d\omega/dt$

$F=m\omega^2 r=(mv^2)/r$

4.0 GENERAL EQUIPMENT DESCRIPTION

4.1 Unit Centrifugal force equipment



A - Acrylic safety cover
B - Rotating disc
C - Force display meter (N)
D - Speed display meter (rpm)
E - Speed Controller (rpm)
F - On/Off Switch
G - Adjustable weights
H - Linear Rod

Figure 2: Centrifugal force equipment

5.0 EQUIPMENT OPERATING PROCEDE

5.1 General Start-up Procedure

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.
5. Switch ON the supply, and then rotate the rotating switch to control the number of rotation.

IMPORTANT:

1. **Don't operate the centrifugal force equipment without closed by acrylic covers.**

5.2 General Shut-down Procedure

1. Rotating the rpm controller to reduce the speed until zero.
2. Turn off the centrifugal force equipment.
3. Switch off the main power supply.

6 EXPERIMENT

Design the experiments in order to meet the given objectives.

7 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 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.