Features

Vibration is defined as the motion of a particle, body or system of connected bodies displaced from a position of equilibrium. Most vibrations in machines and structures are undesirable because they increase stresses, raise energy losses, create additional noise, etc.

Vibrations can be classified into two categories: free and forced. Free vibrations of a system are vibrations that are caused by an initial input and then are allowed to vibrate freely without the application of any external forces. In addition, a damper can be used in a free vibration system to dissipate a certain percentage of energy with each cycle of vibration.

Experiments can be carried out by the students to investigate the relationship between the mass of the body, the stiffness of the spring and the period frequency of oscillation and to observe the effect of viscous damping on the system.

'he basic components of the unit consist of a rigid frame with v ertical mass carriage guides, an upper mounting plate for the spring and a lower mounting plate for the damper. 'he mass carriage is constrained by rollers which run along the vertical guides to provide a single degree of freedom with minimum uncontrolled damping.

A pen, attached to the vibrating frame, and a paper strip, drawn by a synchronous motor, provide a means of producing amplitude0time recordings.

Springs of various stiffness and suitable masses are supplied. 'The damper is adjustable to provide a wide range of damping.

Tesca Free Vibration Apparatus has been designed to perform demonstrations and experiments which provide an understanding of the free vvibrations of a simple spring-mass-damper system.

Demonstrations may be carried out to illustrate free and damped vibrations of a simple spring-mass system having one degree of freedom and the response of a second order mechanical system to a step input.

Specifications

The main structure of the unit is a rigid frame, made of steel and aluminum, with two vertical guides, an upper mounting plate for the spring and a lower mounting plate for the damper. This rigid frame supports the different elements of the unit.

The mass carriage, to which various slotted weights may be attached, is constrained by rollers which run along the vertical guides to provide a single degree of freedom with minimum uncontrolled damping. The lower end of the spring is attached to the mass carriage and the upper end is attached to the frame.This section of the frame is adjustable so that the free position of the carriage may be varied.

The system produces amplitude versus time recordings using a mechanical strip chart

Note: Specifications are subject to change.

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recorder that consists of a drum recorder and a pen holder. the drum recorder is attached to the rigid frame and consists of a drum, driven by a synchronous motor, and a roll of paper. Before being rolled around the drum, the paper passes through a tensioning device that provides enough tension to ensure that the paper speed is constant (0.02 m/s). The pen holder is attached to the mass carriage and uses a spring to maintain continuous contact between the pen tip and the paper on the drum.

Anelectronic console is used to switch the synchronous motor on and off during experiments.

Three springs, with varying stiffness, can be interchanged as the connection between the rigid frame and the mass carriage:

Spring 1: k = 3.30kN/m

Spring 2: k = 1.22kN/m

Spring: k = 0.047kN/m

Five weights of 1 kg each can be added and secured to the mass carriage.

An adjustable oil damper provides controlled damping and can be attached to the carriage by means of a screw.

Oil is provided to fill the damper.

Cables and accessories for normal operation

This unit is supplied with the following manuals. Required Services, Assembly and installation, S tart-up, Safety, maintenance and Practice Manuals.

Experiment Possibilities

- Investigation of the relationship between the mass of the body, the stiffness of the spring and the period/frequency of oscillation for a simple spring mass system with one degree of freedom.
- Investigation of the relationship between the applied force, the viscosity of the oil and the velocity for various settings of the adjustable oil damper.
- Observation of how varying the degree of damping affects the response of a second order mechanical system to a step input.
- Observation of the free vibrations of a system having one degree of freedom.
- Study of the effect of viscous damping on the free vibrations of a simple spring-mass-damper system.
- Determination of the damping ratio for a given spring-mass- damper system.

Services Required

- Mains Supply: 220V Single Phase / 440V Three Phase; 50Hz

Note: Specifications are subject to change.

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