NON-UNIFORM BENDING – DETERMINATION OF YOUNG'S MODULUS

Procedure

The given beam is placed over the two knife edges A and B which are separated by a distance of l (say, l = 60cm). The weight hanger is hung at the center of the beam for which the Young's modulus has to be determined, as shown in figure.

The weight hanger is hung at the middle of the beam and is considered as the dead weight W. A pin is fixed vertically at the mid point of the beam and is viewed through a travelling microscope.

With the dead weight on the hanger, the reading of the microscope corresponding to the tip of the pin is taken. Loads are added to the hanger in steps of 50gm and the microscope readings are taken each time after making the tip of the pin coincide with the cross wire using the vertical fine adjustment knob.

The same procedure is repeated by unloading the weight from the weight hanger in steps of 50 gms and the readings are tabulated in the tabular column. From the readings, the mean of depression s is calculated for a load of M kgs (M=150 gms).

By substituting all the values in the given formula, the Young's modulus of the given material of the beam is calculated.

UNIFORM BENDING - DETERMINATION OF YOUNG'S MODULUS

Procedure :

The given beam is placed over the two knife edges A and B which are separated by a distance of 60 cm. Two weight hangers are suspended, one each on either side of the knife edges at an equal distance of 'a'. A pin is fixed vertically exactly, at the centre of beam as shown in fig.

A traveling microscope is placed in front of this arrangement. Taking the weight hangers alone as the dead load, the tip of the pin is focused by the microscope and adjusted (using the fine adjustment screw) such that the tip of the pin just touches the horizontal cross wire. The reading on the vertical scale of the traveling microscope is noted.

Now, equal weights are added on both the weight hangers, in steps of 50 grams. Each time the microscope is adjusted such that the tip of the pin touches the horizontal cross wire and then the vertical scale readings are noted. The procedure is followed until the maximum load is reached.

The same procedure is repeated by unloading the weight from both the weight hangers in steps of 50 grams and the readings are tabulated in the tabular column. From the readings, the mean of elevation y is calculated.

By substituting all the values in the given formula, the Young's modulus of the given material of the beam is calculated.

LASER - DETERMINATION OF WAVELENGTH OF THE LASER USING GRATING

Procedure

Laser beam, whose wavelength is to be determined, is passed through the grating. The diffracted rays are made to fall on the screen, which is kept at a distance of D from the grating. The diffraction pattern produced is as shown in fig. The distance between the central bright spot and first bright spot on the left is measured. Similarly, the distance between the central bright spot and the second bright spot on the left is measured. This is repeated up to the fifth bright spot on the left. The distances are tabulated. Similarly, the distance between the central bright spot and the bright spots on the right side are measured and tabulated. The wavelength of the given laser source is determined using the given formula. The number of lines in the given grating is (2500 lines per inch) 98425 lines per metre or approximately 10^5 lines per metre.

OPTICAL FIBER - DETERMINATION OF NUMERICAL APERTURE AND ACCEPTANCE ANGLE

Procedure

The given laser source is connected to the optical fibre cable. The other end is exposed to the air medium in the dark place. The emerging light is exposed on a screen. A illuminated circular patch is formed on the screen. The distance from the fiber end to circular image (d) is measured using a metre scale. The radius of the circular image is also measured. The acceptance angle is calculated using the given formula. Using the calculated acceptance angle, the numerical aperture of the cable is found.

COMPACT DISC - DETERMINATION OF WIDTH OF THE GROOVE USING LASER

Procedure

Scratch the label surface of the CD and use a sticky tape to peel off the label and the reflecting layer. Compact disc has pre-groove to help the burner follow the spiral path. The compact disc is mounted on a holder and the light from the laser source is made to fall perpendicular to the surface. As the polycarbonate layer is transparent, the stripped CD acts as a transmission grating. The distance of the CD and the screen is measured and is denoted as D. A diffraction pattern is produced as shown in fig. The distance between the central bright spot and first bright spot on the left is measured. Similarly, the distance between the central bright spot and the second bright spot on the left is measured. This is repeated up to the fifth bright spot on the left. The distances are tabulated. Similarly, the distance between the central bright spot and the bright spots on the right side are measured and tabulated.

With the known wavelength of the given laser source, the spacing between the grooves in a CD is determined.

AIR WEDGE - DETERMINATION OF THICKNESS OF A THIN SHEET/WIRE

Procedure:

Take two optically plane glass plates and using a rubber band keep them in contact at one of their edges and hence an air wedge is formed and a thin wire is introduced with its length perpendicular to length of the plate. The light from the sodium lamp is made to fall vertically on the air wedge film formed between the glass plate and a lens as shown in fig. Alternate dark and bright bands are seen through the microscope and are parallel to the edge of contact.

The microscope is focused on the bands. The center of bright band near the edge of contact of the plane glass plate is made to coincide with the vertical cross wire. Let it be nth band . The reading of the microscope is noted. The microscope is moved without disturbing the position of the glass plates and the vertical cross wire is made to coincide with the center of every fifth bright band and the corresponding readings are noted. Take the readings up to (n + 45)th band . The mean bandwidth is calculated from these reading. Finally, the distance of the wire from the edge of contact is measured using the traveling microscope. Assuming the wavelength of sodium light as 5893×10^{-10}m the diameter of the diameter of the wire is calculated. Repeat the same experiment for the determination of the thickness of the paper by inserting a piece of paper between the plates.

SIMPLE HARMONIC OSCILLATIONS OF CANTILEVER

Procedure

One end of the bar is clamped firmly and the length of the cantilever is measured. The breadth of the beam is measured using a vernier calipers and the thickness of the beam is measured using a screw gauge. Weights are added in steps to the free end of the cantilever and the free end is set in oscillation. Using a stop watch, the time taken for 10 oscillations for different weights at the free end are noted. A graph is plotted by taking time period squared as the x-axis and the mass at the free end as the y-axis. The slope of this curve gives the Young's modulus of the material of the beam.

Ultrasonic interferometer – Determination of velocity of sound and compressibility of liquids

Procedure

Initial adjustments

In the high frequency generator two knobs are provided for initial adjustments. One is marked with "Adj" (set) and the other with "Gain" (sensitivity). With knob marked "adj" the position of the needle on the ammeter is adjusted and with the knob marked "gain" the sensitivity of the instrument can be increased for greater deflection, if desired.

The electrodes are connected to the output terminal of the frequency generator through a shielded cable. The cell is filled with the experimental liquid (water) before switching ON the generator. Now, when the frequency generator is switched ON, the ultrasonic waves move normal from the quartz crystal till they are reflected back by the movable reflector plate. Hence stationary waves are formed in the liquid in between the reflector plate and the quartz crystal. The distance between the reflector and crystal is varied using the micrometer screw such that the anode current of the current increases to maximum and then decreases to minimum and again increases to maximum. The distance of the separation between two successive maximum or two successive minimum in the anode is equal to half the wavelength of the ultrasonic waves in the liquid. Therefore, by noting the initial and final position of the micrometer screw for one complete oscillation (maxima-minima-maxima) the distance moved by reflector can be determined.

To minimize the error, the distance d moved by the micrometer screw is noted for x oscillations (successive maxima) and readings are tabulated. From the total distance d moved by the micrometer screw and the number of oscillations x, the wavelength of ultrasonic waves can be determined using the formula $\lambda = \frac{2d}{x}$. From the value of λ and by noting the frequency of the generator f, the velocity of the ultrasonic waves can be calculated using the given formula. After determining the velocity of the ultrasonic waves in liquid, the compressibility of the liquid is calculated using the given formula.