EXPERIMENT 3 : TORSION OF A GERCULAR SHAFTS

AIM DEJECTIVE: The aim of experiment is to obtain torque - frist relationship for an aluminium circular shaft and compare the result with theoretical predictions

EXPERIMENTAL METHOD (S) :

Equipments: Torsion setup, solid circular rod of Al, Vernier Callibers

Theory: In this experiment, assumption of the metal being perfectly plastic was taken. Normally, in stressstoain relationship, the initial portion is linear i.e. the clastic region. Once the stress exceeds yield stress, the relationship is doesn't remain linear and deforms plastically. It is called strain hardening.

When metal shaft is subjected to sufficiently high torque, plastic deformation stoots at outermost fiber first and moves inwards as torque is increased. Evidently for a particular torque value, the entire cross section is in a state of a plastic deformation. For an elastic perfectly plastic shaft, beyond this point, the short cannot resist further torque This torque is called Uniting torque (Ti) for the shaft. The Torque (T) - twist (O) relation for perfectly plastic material is given by,

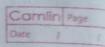
 $T = \begin{pmatrix} 4 \\ 3 \end{pmatrix} T_y \left(1 - 0.25 \left(\frac{0}{9} \right)^{9} \right)$

where Ty and Dy are the torque and angle of twist at

Also, Ty = (J* Ty)/R J = Polar moment of inextia.

Ty = Yield stress in Shear.

TL = 4 Ty (0=0)



The specimen is fitted in the machine and gauge length of loo mm is taken. Two senors are put at each end one end is morable white other is fixed. The machine is connected to the software which takes readings and plots automatically.

BOUNDARY CONDITIONS ?

- · Gauge Length (L) = 100 mm · Diameter of the shoft (d) = 10 mm
- · Maximum observed angle of twist Dmax = 2565. 190674"

1 RESULTS:

ANALYSIS :

Ty, exp = Torque at which linear region ends = 24.22717094 Nm

Th, exp = Torque in the flat region of curve = 31.66979027 N-m

TL, ther = 4 Ty, exp = 4 x 24.22717094 = 32.3028946 Nm

1 error = (TL, ther - TL, exp) x 100 = 1.95 98 1.

TL, there

Calculation of g: Done in linear region of curve. $\frac{G}{G} = \frac{TL}{JD} = \frac{32TL}{TDDD} = \frac{32 \times 19.45475047 \times D \cdot 1}{TT \times 0.0797511 \times (10-2)^4}$

T= 19.45470047

0 = 4.569+05079' = 0.079\$ 11 dad

: Gexp = 24. 8478 GPa Gin = 25 GPa

1/ error = 25-24.8478 ×100 = 0.67.

Tmax = 31.78 204155 Nm

O CONCLUSION :

1) The linear line marked becomes helical which just rotated ther 2) Facture was observed near tight screws due to the effect on stress concentration.

SOURCES OF ERROR :

- I) Screws might not be properly fightened causing inaccuracies in angle of twist.
- 2) Parallax errors in taking readings from Vernier Calliper.
 3) Slipping between encoder and the metallic disk.