Program for design of shaft, Problem Number 6.

Problem Statement:A line shaft is to transmit 30 kW at 160 rpm. It is driven by a motor placed directly below it by means of a belt running on a 1 m diameter pulley keyed to the end of shaft. The tension on the tight side of the belt is 2.5 times that on the slack side and the centre of the pulley overhangs 150mm beyond the centre line of the end bearing. Determine the diameter of the shaft, if the allowable shear stress is 60 N/mm2 and the pulley weighs 1600 N. Assume minor shock conditions.

Name: Avva Sai Pranav

USN : PES1201800861

Date : 13/09/2020

```
clc;
clear all;
```

Given Data:

P = 30 kw

n =160rpm

d = 1000mm

r = 500mm

1 = 2.52

Tu_all = 60 N/mm^2

```
P = 30;
n =160;
d_pulley = 1000;
r = d_pulley/2;
W = 1600;
L = 150;
Tu_all = 60;
Tu_max = Tu_all;
```

Finding the toruque for given power:

```
T = Eqn_3_3_a(P,n)
```

```
T = 1790625
```

For a belt drive:

T = (T1-T2)xr

```
syms T1_temp  T2_temp;
eqn = [T1_temp ==2.5*T2_temp , T == (T1_temp - T2_temp)*r]
```

eqn =

$$\left(T_{1,\text{temp}} = \frac{5\,T_{2,\text{temp}}}{2} \quad 1790625 = 500\,T_{1,\text{temp}} - 500\,T_{2,\text{temp}}\right)$$

```
T_sol = solve(eqn,[T1_temp,T2_temp]);
T1 = T_sol.T1_temp
```

T1 =

$$\frac{23875}{4}$$

```
T2 = T_sol.T2_temp
```

T2 =

$$\frac{4775}{2}$$

Total load acting on the shaft = total belt tension + weight of the pulley

```
F = T1 + T2 + W
```

F =

$$\frac{39825}{4}$$

Find the Moment of the shaft

```
M = -F*L
```

M =

$$-\frac{2986875}{2}$$

```
M_max = M;
```

Using the table for loads we get:

```
Cm = 2;
Ct = 1.5;
```

Using the maximum shear stress theory.

Maximan stress is taken as one for the sake of the function to short circuit. zero could be given but it would yield and inf value.

```
S_max = 1
```

S_max = 1

```
[d_n, d_s] = Eqn_3_6(1,Tu_max,M_max,T,Cm,Ct);
d = d_s
```

```
d =
```

$$\left(\frac{17202483417667978125\ \sqrt{2039869}}{72057594037927936}\right)^{1/3}$$

Find the standard diameter from the table:

```
d = Table_3_5_a(d)
```

```
Standard size of the shaft (mm) using table 3.5(a) is :
    71
```