The Hashemite

University
Faculty Of Engineering
Mechanical Engineering Department

Strength Of Materials Lab

# Deflection of Beams

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## 9p,Result and calculations:

| | | | |
|---|---|---|---|
| **Rod material** | Steel | **Modulus of Elasticity** | 210 GPa |
| **Length** | 1000 mm | **Cross section dimension** | (20 x 6) mm |
| **Cross section type** | Rectangle | **Ends condition** | Simply supported |

Experiment parameters

**Part (1)**: Measurement of the reaction forces: The load = 10N

| **Distance X from support A (mm)** | **Experimental** | | **Theoretical** | | **Percentage Error (%)** | |
|---|---|---|---|---|---|---|
| | **Reaction force A (N)** | **Reaction force B (N)** | **Reaction force A (N)** | **Reaction force B (N)** | **Reaction force A** | **Reaction force B** |
| 100 | 8.4 | 0.9 | 9 | 1 | 6.66% | 10% |
| 200 | 7.4 | 1.9 | 8 | 2 | 7.50% | 5% |
| 300 | 6.5 | 3.1 | 7 | 3 | 7.14% | 3.33% |
| 400 | 5.5 | 4.05 | 6 | 4 | 8.33% | 1.25% |
| 500 | 4.3 | 5 | 5 | 5 | 14% | 0% |

Experiment data and result

Sample of calculation:

For Reaction A : X=400 ; R=F(1-X/L) Then >> 10(1-400/1000)=6N .

Now : to calculate the error ; E =( theo – exp )/ theo*100% ; Then>> E = (6-5.5)/6=8.33%

For Reaction B : X=500 ; R= FX/L Then >> 10*500/1000= 5N .

Now : to calculate the error ; E =( theo – exp )/ theo *100%; Then>> E =(5-5)/5 = 0%

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## **Part (2)**: Deflection of simply supported beam: The load = 10N

| Distance X from support A (mm) | Deflection W (Experimental) mm | Deflection W (Theoretical) mm | Percentage Error (%) |
|---|---|---|---|
| 100 | 0.8 | 0.7 | 14.2% |
| 200 | 1.75 | 1.51 | 15.8% |
| 300 | 2.45 | 2.11 | 16.1% |
| 400 | 2.8 | 2.52 | 11.1% |
| 500 | 2.9 | 2.6 | 11.5% |

Experiment data and result

Sample of calculation:

For X=500mm; deflection will be on max value because it is in the middle of the beam >>

W(x)= F*L^3/48 * E*I

BUT : I = bh^3/12 then ; I = 20mm*6mm^3/12 = 3.6*10^-10

NOW: 10*1000mm^3/48*216G*3.6*10^-10 = 2.67mm

Error = 2.6-2.9/2.6 *100% = 11.5%

## **Part (3)**: Cantilever beam Deflection: The load = 10N

| Length L from clamp (mm) | Deflection W (Experimental) mm | Deflection W (Theoretical) mm | Percentage Error (%) |
|---|---|---|---|
| 200 | 0.4 | 0.3 | 33.3% |
| 300 | 1.3 | 1.15 | 13.04% |
| 400 | 2.8 | 2.74 | 2.18% |

Experiment data and result

For L=300 ; by applying w(x)=FL^3/3EI …Then >> 10*300mm^3/3*216G*3.6*10^-10= 1.15mm.

E=((1.15-1.3)/1.15)*100%=13.04%

State the sources of error?

1- Reading the dynamometer because the difference in angle of view .
2- Beams are not completely straight .
3- The effective of vibration on dialgage reading .

Comment on your results in each case:

**Part (1): for reaction A due to distance X , increasing distance will cause a low reaction and the error will be too high that's very bad by comparing with experimental result . On the other hand , Reaction due to distance X-L will increase and the error will be too low which is very good by comparing with experimental result .**

**Part (2): it is observed that for X=500mm deflection will be on max value because it is in the middle of the beam ,As for other results are normal there is no difference comparing with part 1 .**

**Part (3): By increasing the length of beam the deflection will increasing truly .**

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