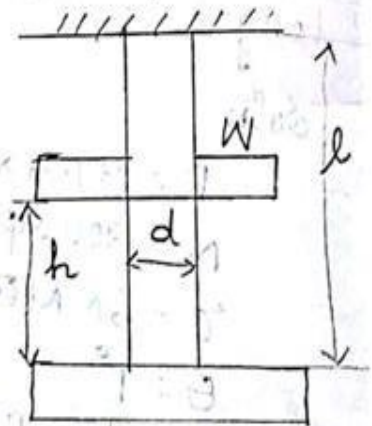




## Impact stress

The machine element subjected to load with impact, the stress produced in the member due to falling load is known as impact stress.

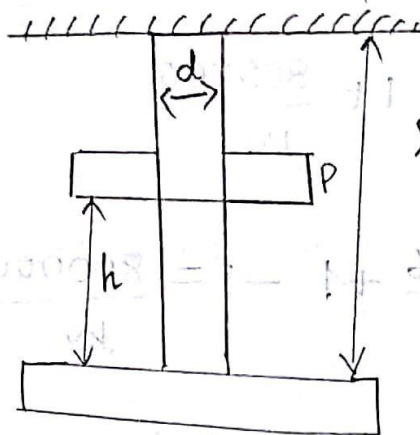
$$\sigma_i = \frac{Wl}{A} \left[ 1 + \sqrt{1 + \frac{2hAE}{Wl}} \right]$$



1. A unknown weight falls

through 10 mm on the collar rigidly attached to lower end of vertical bar 3m length and 600 mm<sup>2</sup> in cross section. The maximum extension is to be 2mm

What is the corresponding stress value of unknown weight.  $E = 200 \text{ kN/mm}^2$ !



$$h = 10 \text{ mm}$$

$$l = 3000 \text{ mm}$$

$$A = 600 \text{ mm}^2$$

$$\delta l = 2 \text{ mm}$$

$$E = 200 \times 10^3 \text{ N/mm}^2$$

$$\sigma_i = \frac{W}{A} \left[ 1 + \sqrt{1 + \frac{2hAE}{Wl}} \right]$$

$$e = \frac{\delta l}{l} = \frac{2}{3000} = 6.6 \times 10^{-4}$$

$$\sigma_i = E \times e$$

$$= 200 \times 10^3 \times 6.6 \times 10^{-4}$$

$$\sigma_i = 133.33$$

$$133.33 = \frac{W}{600} \left[ 1 + \sqrt{1 + \frac{2 \times 10 \times 600 \times 200 \times 10^3}{W \times 3000}} \right]$$

$$79998 = W \left[ 1 + \sqrt{1 + \frac{800000}{W}} \right]$$

$$\frac{79998}{W} = 1 + \sqrt{1 + \frac{800000}{W}}$$

$$\frac{79998}{W} - 1 = \sqrt{\frac{800000}{W} + 1}$$

$$\left(\frac{79998}{W} - 1\right)^2 = 1 + \frac{800000}{W}$$

$$\frac{6399 \times 10^6}{W^2} - \frac{159996}{W} + 1 = 1 + \frac{800000}{W}$$

$$\frac{6399 \times 10^6}{W^2} = \frac{800000}{W} + \frac{159996}{W}$$

$$\frac{6399 \times 10^6}{W^2} = \frac{959996}{W}$$

$$W = 6665.6 \text{ N}$$

1. Unknown weight falls from 15 mm on to the collar rigidly attached to lower end of the vertical bar 2.5 m long and 500 mm<sup>2</sup> is section. The maximum instantaneous extension is to be 2 mm. Find the corresponding stress and the value of weight falling. Assume  $E = 2 \times 10^5 \text{ N/mm}^2$ .

$$h = 15 \text{ mm}$$

$$l = 2.5 \text{ m} = 2500 \text{ mm}$$

$$A = 500 \text{ mm}^2$$

$$\delta l = 2 \text{ mm}$$

$$E = 2 \times 10^5 \text{ N/mm}^2$$

$$\sigma_i = \frac{W}{A} \left[ 1 + \sqrt{1 + \frac{2hAE}{Wl}} \right]$$

$$e = \frac{\delta l}{l} = \frac{2}{2500} = 8 \times 10^{-4}$$

$$\begin{aligned} \sigma_i &= E \times e \\ &= 2 \times 10^5 \times 8 \times 10^{-4} \\ &= 160 \text{ N/mm} \end{aligned}$$

$$160 = \frac{W}{500} \left[ 1 + \sqrt{1 + \frac{2 \times 15 \times 500 \times 2 \times 10^5}{W \times 2500}} \right]$$

$$80000 = W \left[ 1 + \sqrt{1 + \frac{1200000}{W}} \right]$$

$$\frac{80000}{W} = 1 + \sqrt{1 + \frac{1200000}{W}}$$

$$\left[ \frac{80000}{W} - 1 \right]^2 = 1 + \frac{1200000}{W}$$

$$\frac{64 \times 10^8}{W^2} - \frac{160000}{W} + 1 - 1 = \frac{1200000}{W}$$

$$\frac{64 \times 10^8}{W^2} = \frac{1360000}{W}$$

$$W = 4705.8 \text{ N}$$

$$\left[ \frac{80000}{W} + 1 \right]^2 = 1 + \frac{1200000}{W}$$

$$\left[ \frac{80000}{W} + 1 \right]^2 = 1 + \frac{1200000}{W}$$

$$\left[ \frac{80000}{W} + 1 \right]^2 = 1 + \frac{1200000}{W}$$