

**Question #81300, Engineering / Mechanical Engineering**

A torsional pendulum when immersed in oil indicates its natural frequency of 200 Hz. But when it was put to vibration in vacuum having no damping, its natural frequency has observed as 250 Hz. Find the value of damping factor of the oil.

**Solution**

$$\frac{f_d}{f_n} = \cos(1 - \zeta^2)$$

$$1 - \zeta^2 = \cos^{-1} \frac{f_d}{f_n}$$

The value of damping factor of the oil:

$$\zeta = \sqrt{1 - \cos^{-1} \frac{f_d}{f_n}}$$

$$\zeta = \sqrt{1 - \cos^{-1} \frac{200}{250}} = 0.60$$

**Answer: 0.60.**