

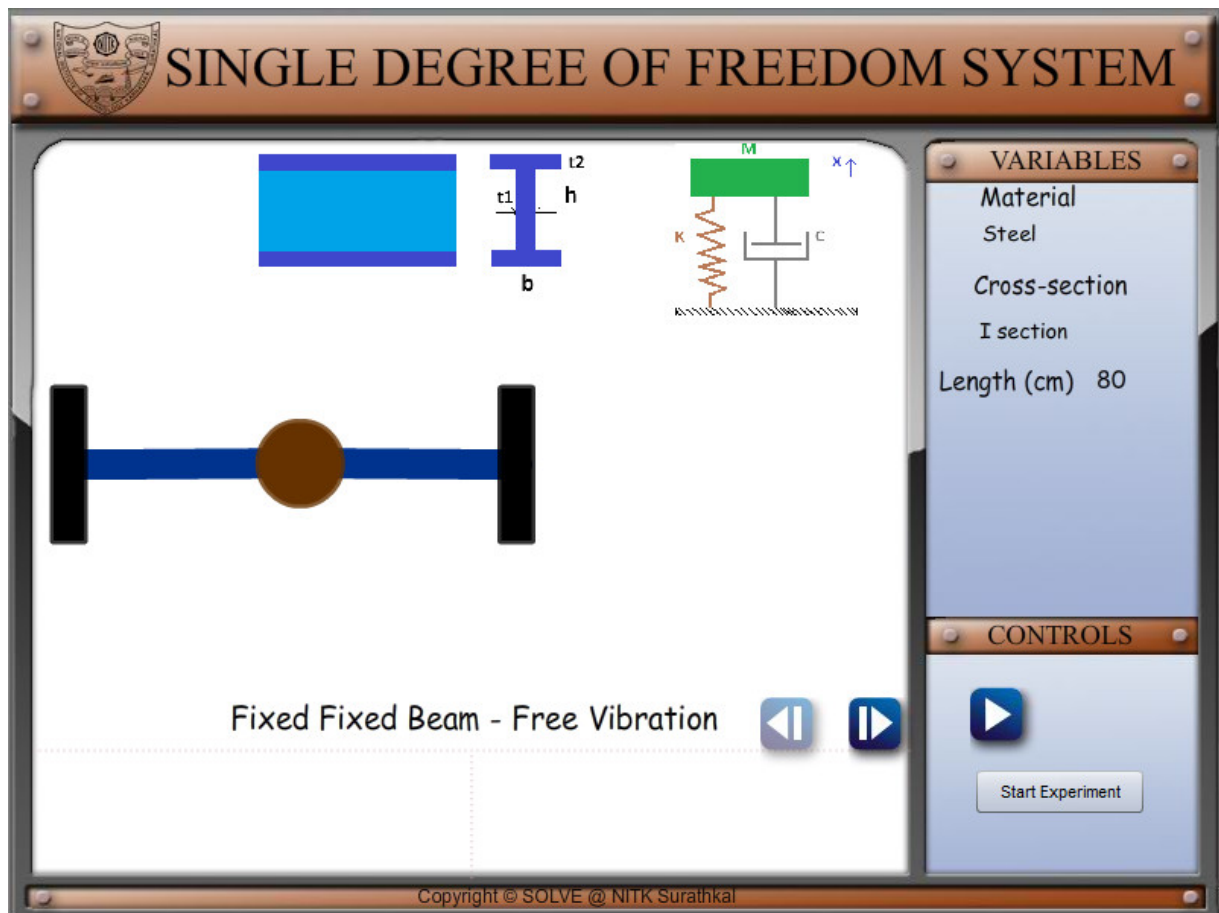
FREE VIBRATION SDOF SYSTEM - expT PROCEDURE

AIM:

To find the damping (c) of the given beam.

PROCEDURE:

Begin the experiment by clicking the start experiment button.



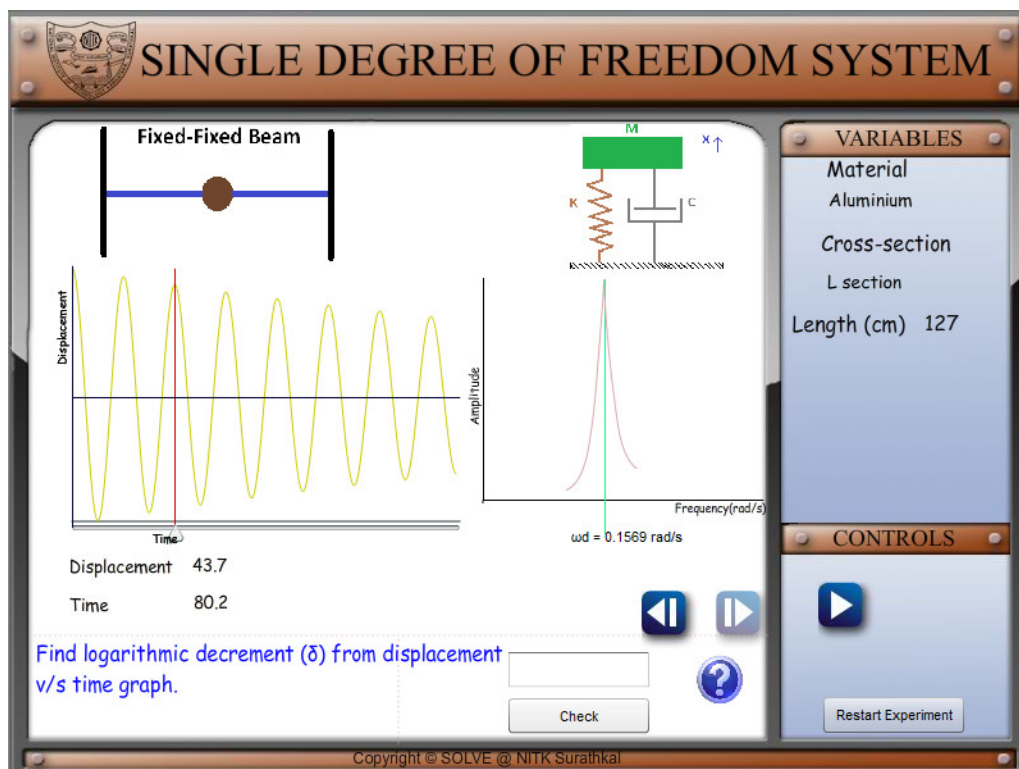
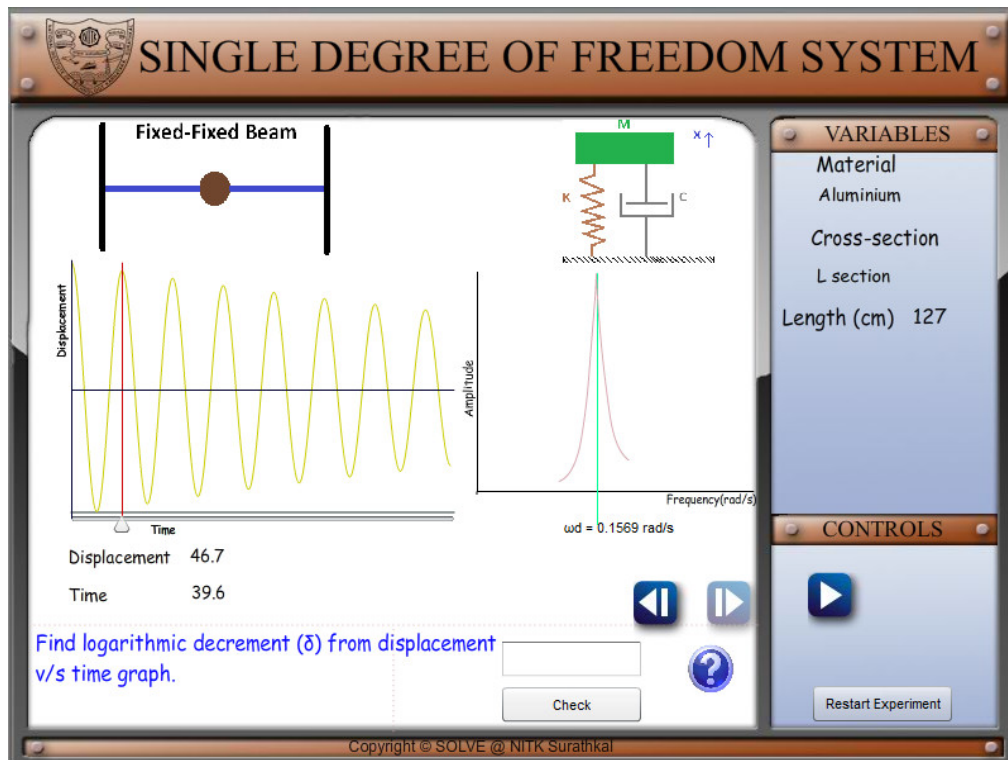
1. Find logarithmic decrement (δ) from displacement v/s time graph.

The logarithmic decrement is defined as follows.

$$\delta = \frac{1}{n} \ln \left(\frac{x_1}{x_n} \right)$$

Here x_1 and x_n refer to the displacements at the first and n^{th} peak in the displacement v/s time graph. The displacements at the peaks can be found using the location slider.

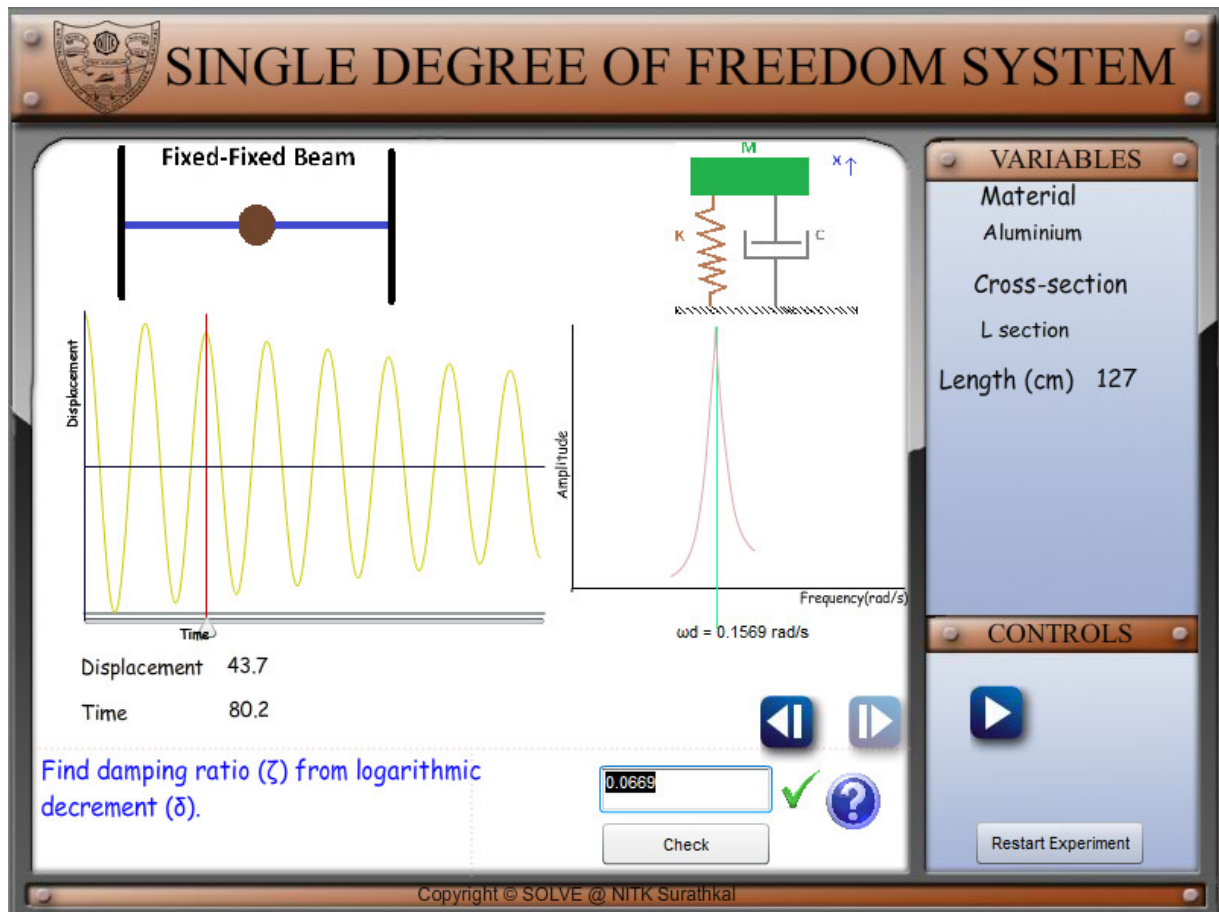
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2. Find the damping ratio (ζ) from the logarithmic decrement (δ). The damping ratio is given by

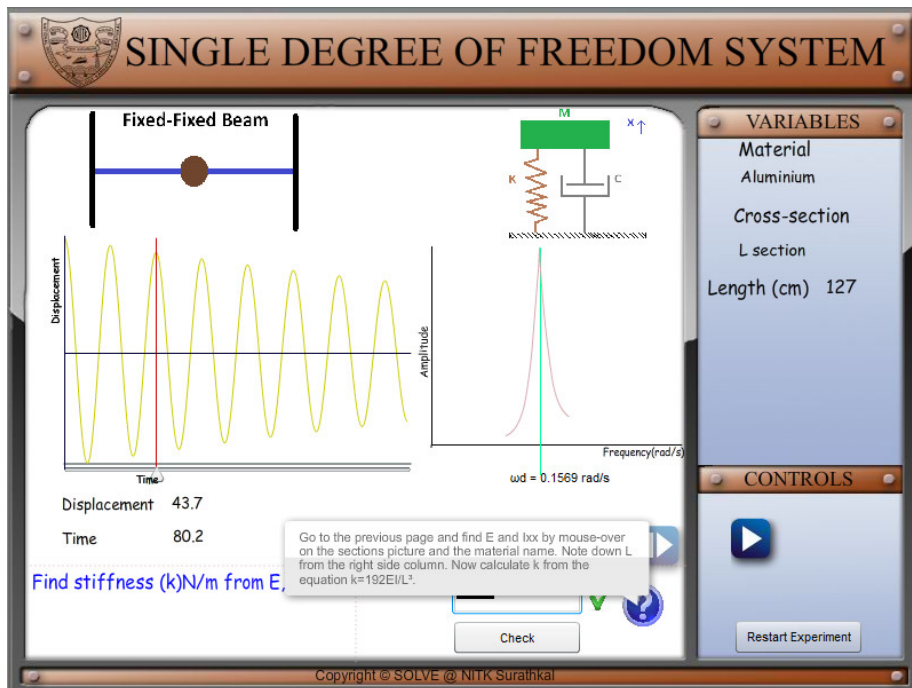
$$\zeta = \frac{1}{\sqrt{1 + \left(\frac{2\pi}{\delta}\right)^2}}$$



3. Find beam stiffness (k) N/m from Young's modulus (E), area moment of inertia (I) and length (L). The stiffness for different beams is given below.

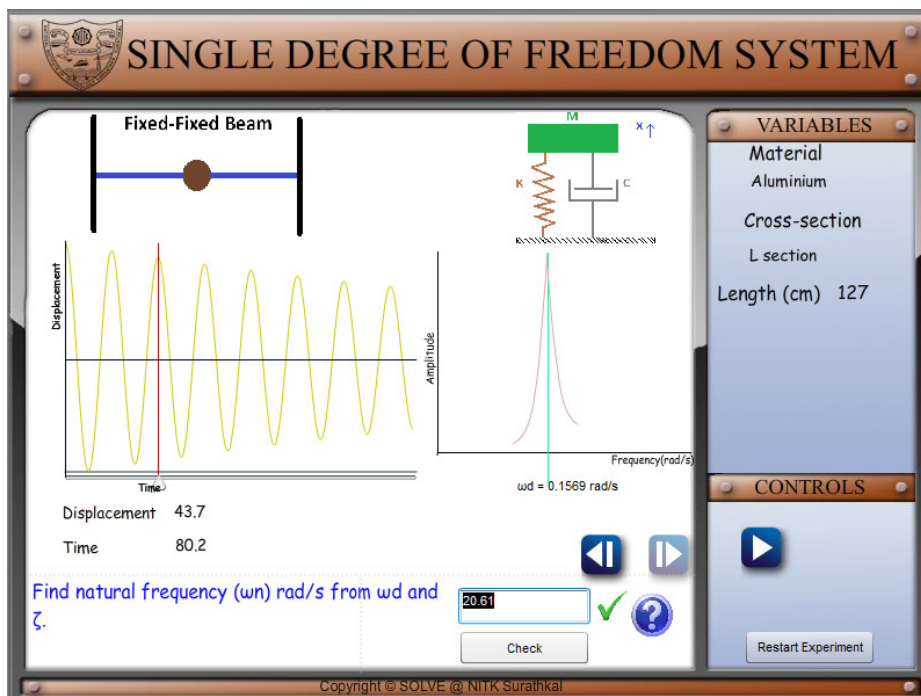
Cantilever beam	$k = \frac{3EI}{L^3}$
Simply supported beam	$k = \frac{48EI}{L^3}$
Fixed Fixed beam	$k = \frac{192EI}{L^3}$

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4. Find natural frequency (ω_n) rad/s from ω_d and ζ . ω_d can be found from the FFT in the graph window.

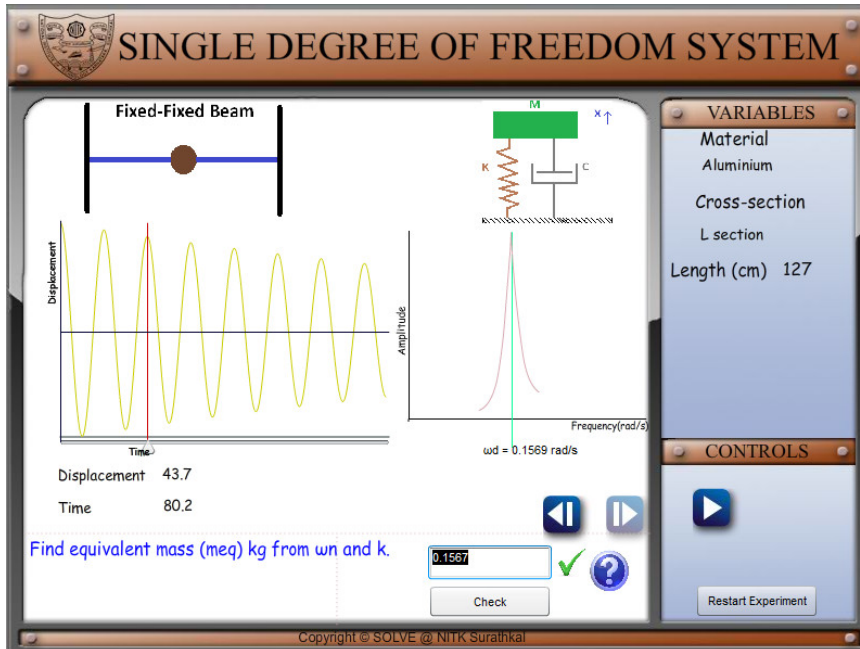
$$\omega_n = \frac{\omega_d}{\sqrt{1 - \zeta^2}}$$



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5. Find equivalent mass (m_{eq}) kg from ω_n and k .

$$m_{eq} = \frac{k}{\omega_n^2}$$

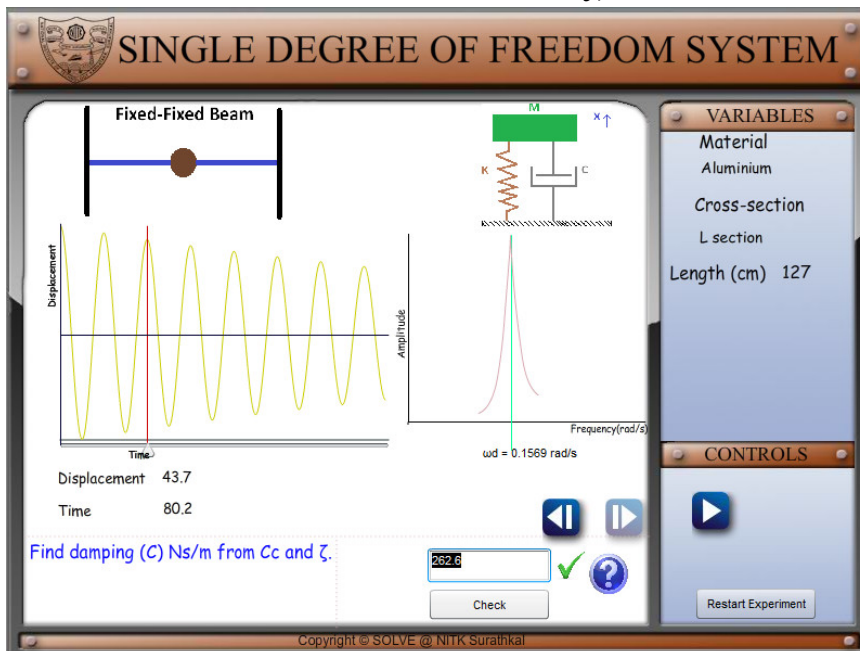


6. Find critical damping (c_c) Ns/m from m_{eq} and k .

$$c_c = 2\sqrt{km}$$

7. Find damping (c) Ns/m from C_c and ζ .

$$c = c_c \zeta$$



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RESULT:

System damping 'c' has been found. The basic concepts in free vibration of SDOF systems are covered.

SINGLE DEGREE OF FREEDOM SYSTEM

Fixed-Fixed Beam

Variable	Actual	Entered
Logarithmic Decrement (δ)	0.06691533320531265	0.0669
Damping Ratio (ζ)	0.010649302140809596	0.0106
Stiffness (k)	20.612933007469795	20.61
Natural Frequency (ω_n)	0.15698879328551724	0.1567
Equivalent Mass (meq)	836.3777856789524	836.34
Critical Damping (C_c)	262.6038786091034	262.6
Damping (C)	2.796548046656828	2.796

VARIABLES

Material
Aluminium

Cross-section
L section

Length (cm) 127

CONTROLS

CONGRATULATIONS! YOU HAVE SUCCESSFULLY COMPLETED THIS expT.

2.796

Check

Restart Experiment

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