

Chapter 2


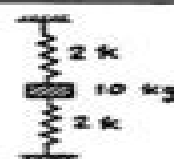
Free Vibration of Single Degree of Freedom Systems

2.1 $\xi_{yt} = 5 \times 10^{-3} \text{ m}$
 $\omega_n = \left(\frac{g}{\xi_{yt}} \right)^{1/2} = \left(\frac{9.81}{5 \times 10^{-3}} \right)^{1/2} = 44.2945 \text{ rad/sec} = 7.0497 \text{ Hz}$

2.2 $\tau_n = 0.21 \text{ sec} = 2\pi \sqrt{\frac{m}{k}}$, $\sqrt{m} = 0.21 \sqrt{k} / 2\pi$
 (i) $(\tau_n)_{\text{new}} = \frac{2\pi \sqrt{m}}{\sqrt{k_{\text{new}}}} = \frac{2\pi \sqrt{m}}{\sqrt{1.5k}} = \frac{2\pi \left(\frac{0.21 \sqrt{k}}{2\pi} \right)}{\sqrt{1.5k}} = 0.1715 \text{ sec.}$
 (ii) $(\tau_n)_{\text{new}} = \frac{2\pi \sqrt{m}}{\sqrt{k_{\text{new}}}} = \frac{2\pi \sqrt{m}}{\sqrt{0.5k}} = 2\pi \left(\frac{0.21 \sqrt{k}}{2\pi} \right) \frac{1}{\sqrt{0.5k}} = 0.2970 \text{ sec.}$

2.3 $\omega_n = 62.832 \text{ rad/sec} = \sqrt{\frac{k}{m}}$, $\sqrt{m} = \sqrt{k} / 62.832$
 when spring constant is reduced, ω_n decreases.
 $(\omega_n)_{\text{new}} = 0.55 \omega_n = 34.5576 \text{ rad/sec} = \sqrt{\frac{k_{\text{new}}}{m_{\text{new}}}} = \sqrt{\frac{k-800}{m}}$
 $\sqrt{\frac{k-800}{k}} \times 62.832 = 34.5576$, $\sqrt{\frac{k-800}{k}} = 0.55$
 $\frac{k-800}{k} = (0.55)^2 = 0.3025$
 $k = 1146.9534 \text{ N/m}$
 $\sqrt{m} = \sqrt{k} / 62.832$; $m = k / 62.832^2 = \frac{1146.9534}{3947.8602}$
 $m = 0.2905 \text{ kg}$

2.4 $k = 100 / \left(\frac{10}{1000} \right) = 10000 \text{ N/m}$
 $\omega_n = \sqrt{\frac{k_{\text{eq}}}{m}} = \sqrt{\frac{4k}{m}} = \left(\frac{4 \times 10^4}{10} \right)^{1/2}$
 $= 63.2456 \text{ rad/sec}$
 $\tau_n = \frac{2\pi}{\omega_n} = \frac{6.2832}{63.2456} = 0.0993 \text{ sec}$

Chapter Two Solution Manual Rao Vibrations

ML Morrison



Chapter Two Solution Manual Rao Vibrations:

Introductory Course on Theory and Practice of Mechanical Vibrations J. S. Rao, 1999 The Book Presents The Theory Of Free Forced And Transient Vibrations Of Single Degree Two Degree And Multi Degree Of Freedom Undamped And Damped Lumped Parameter Systems And Its Applications Free And Forced Vibrations Of Undamped Continuous Systems Are Also Covered Numerical Methods Like Holzers And Myklestads Are Also Presented In Matrix Form Finite Element Method For Vibration Problem Is Also Included Nonlinear Vibration And Random Vibration Analysis Of Mechanical Systems Are Also Presented The Emphasis Is On Modelling Of Engineering Systems Examples Chosen Even Though Quite Simple Always Refer To Practical Systems Experimental Techniques In Vibration Analysis Are Discussed At Length In A Separate Chapter And Several Classical Case Studies Are Presented Though The Book Is Primarily Intended For An Undergraduate Course In Mechanical Vibrations It Covers Some Advanced Topics Which Are Generally Taught At Postgraduate Level The Needs Of The Practising Engineers Have Been Kept In Mind Too A Manual Giving Solutions Of All The Unsolved Problems Is Also Prepared Which Would Be Extremely Useful To Teachers

Nonlinear Vibration and Dynamics of Smart Continuous Structures and Materials Majid Ghadiri, 2025-05-08 Nonlinear Vibration and Dynamics of Smart Continuous Structures and Materials delves into intricate subjects concerning the analysis of nonlinear vibration issues in continuous structures It covers general concepts and a history of nonlinear systems before evolving into kinetics and solution methods of continuous structures Exploring the implementation of new types of materials in various sectors of automobile aerospace and structural engineering the book provides applicable information on the behaviors of smart structures The book provides a set of mathematical formulations to solve nonlinear static and dynamic behaviors of smart continuous structures by applying principles of elasticity The book will interest academic researchers and graduate students studying structural engineering mechanics of solids and smart materials

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