

## SOLUTION

1. Mass, stiffness, and natural period of the SDOF system: Since we assumed the beam to be rigid, the stiffness of the system is given by the sum of column lateral stiffnesses. The mass and stiffness of the SDOF system are calculated as follows:

Mass,

$$m = \frac{W}{g} = \frac{1500 \text{ lbs}}{386.4 \text{ in/s}^2} = 3.88 \text{ lb-s}^2/\text{in}$$

Stiffness (see [Table 3.1](#)), when both columns are fixed-pinned,

$$k = \frac{12EI}{d^3} = \frac{12EI}{d^3} = 2 \left( \frac{3.29(1000,000 \text{ psi})(75 \text{ in}^4)}{(12.5 \text{ ft} \times 12 \text{ in/ft})^3} \right) = 22,374 \text{ lb/in}$$

The natural period of the system is

$$T_n = 2\pi \sqrt{\frac{m}{k}} = 2\pi \sqrt{\frac{3.88 \text{ lb-s}^2/\text{in}}{22,374 \text{ lb/in}}} = 0.262 \text{ s}$$

2. Determine the maximum displacement for ductility of 4,  $u_m$ : First determine  $A$  due to an 84.7% design spectrum, scaled to 0.5g PG<sub>A</sub>, by entering the response spectrum in [Figure 3.22](#) with  $T_n = 0.26 \text{ s}$ , which is in the acceleration-sensitive region,

$$A = a = 2.7 \text{ lg} = 0.5(2.7 \text{ lg}) = 1.335g$$

The maximum displacement is computed using Equation 5.28 and [Figure 5.18](#),

$$u_m = \mu \left( \frac{T_n}{2\pi} \right)^2 A = \mu \left( \frac{T_n}{2\pi} \right)^2 \frac{A}{\sqrt{2\mu - 1}} = 4 \left( \frac{0.262 \text{ s}}{2\pi} \right)^2 \frac{1.335(386.4 \text{ in/s}^2)}{\sqrt{2(4) - 1}} = 1.353 \text{ in}$$

3. Determine the required column strength for a ductility of 4,  $P_u$ : To determine  $P_u$ , use  $A = 1.335g$  and Equation 5.29,

$$P_u = m\ddot{u}_m = \frac{m A}{\sqrt{2\mu - 1}} = \frac{3.88 \text{ lb-s}^2/\text{in}(1.335)(386.4 \text{ in/s}^2)(4)}{\sqrt{2(4) - 1}} = 770 \text{ lbs}$$

## PROBLEMS

- 5.1 Use the MATLAB script provided in [Chapter 4](#), Example 4.13 to draw response spectra for the displacement, velocity, and acceleration for an SDOF system subjected to the 1994 Northridge earthquake ground acceleration for 2%, 5%, and 10% damping.
- 5.2 The building frame shown is subjected to the El Centro earthquake; determine the total stiffness, structural period, deflection of the beam, base shear, and bending stresses in each of the columns. The roof weighs 10 kips and the substructure has 5% damping, modulus of elasticity,  $E = 29,000 \text{ ksi}$ , and the other geometric properties shown.

# Solutions Manual For The Dynamics Of Heat

**Hussin A.Rothana**



## **Solutions Manual For The Dynamics Of Heat:**

**Solutions Manual for The Dynamics of Heat** Hans U. Fuchs, 2012-12-06 This manual contains detailed solutions of slightly more than half of the end of chapter problems in The Dynamics of Heat The numbers of the problems included here are listed on the following page A friend who knows me well noticed that I have included only those problems which I could actually solve myself Also to make things more interesting I have built random errors into the solutions If you find any of them please let me know Also if you have different ways of solving a problem I would be happy to hear from you Any feedback also on the book in general would be greatly appreciated There is an Errata sheet for the first printing of The Dynamics of Heat By the time you read this it should be available on the Internet for you to download A reference to the URL of the sheet can be found in the announcement of my book on Springer's WWW pages [www.springer-ny.com](http://www.springer-ny.com) Winterthur 1996 Hans Fuchs vi Numbers of Problems Solved Prologue 1 2 4 5 6 8 12 13 17 19 23 25 27 30 32 33 34 38 39 40 42 44 47 49 50 53 55 60 61 62 Chapter 1 2 4 5 8 9 11 13 15 16 17 18 20 21 24 26 27 29 31 33 34 37 39 41 42 44 45 47 49 51 53 55 57 58 60 62 Chapter 2 1 3 5 6 7 9 10 12 14 15 16 17 19 20 22 23 24 26 27 29 30 32 33 36 37 38 41 42 46 47 49 Interlude 2 3 4 5 6 8 10 11 12 13 18 19 20 21 23 24 28 Chapter 3 2 4 6 8 10 12 15 16 17 18 22 24 25 28 30 31 35 36 Chapter 4 1 2 4 6 8 9 11 12 13 15 18 20 21 22 25 27 28 29 30 31 33 34 35 39 40 43 44 46 Epilogue 1 2 11 PROLOGUE Solutions of Selected Problems 2 PROLOGUE Problem 1 Calculate the hydraulic capacitance of a glass tube used in a mercury pressure gauge The inner diameter of the tube is 8.0 mm *Introduction to Thermal Sciences* Frank W. Schmidt, 1993-01-04 *Introduction to Experimental Methods* Terry W. Armstrong, 2023-07-31 Introduction to Experimental Methods succinctly explains fundamental engineering concepts in mechanics dynamics heat transfer and fluid dynamics From conceptualizing an engineering experiment to conducting a comprehensive lab this book enables students to work through the entire experimental design process Offering a complete overview of instruction for engineering lab methodology the book includes practical lab manuals for student use directly complementing the instruction Numerous worked examples and problems are presented along with several hands on experiments in individual lab manuals This book discusses how to write lab reports how to configure a variety of instruments and equipment and how to work through failures in experimentation Introduction to Experimental Methods is intended for senior undergraduate engineering students taking courses in Experimental Methods Instructors will be able to utilize a Solutions Manual for their course Features Provides an overview of experimental methods in mechanics dynamics heat transfer and fluid dynamics Covers design of experiments instruments and statistics Discusses SolidWorks and PASCO Capstone software Includes numerous end of chapter problems and worked problems Features a Solutions Manual for instructor use **Design of Thermal Energy Systems** Pradip Majumdar, 2021-06-01 Design of Thermal Energy Systems Pradip Majumdar Northern Illinois University USA A comprehensive introduction to the design and analysis of thermal energy systems Design of Thermal Energy Systems covers the fundamentals and applications in thermal

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