

2.1 Solution

(a) Determine the equation of motion of the mass m in Fig. 1.

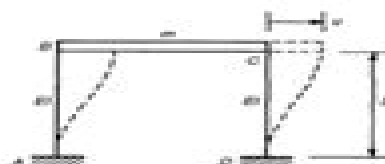


Figure 1

To determine the stiffness of the columns, we can use the unit dummy load method.



Figure 2

$$\begin{aligned} u &= \int_0^L \frac{(-Fx)(-x)}{EI} dx + \int_0^L \frac{M(-x)}{EI} dx \\ &= \frac{FL^3}{3EI} - \frac{ML^2}{2EI} \\ \theta &= \int_0^L \frac{(-Fx)(1)}{EI} dx + \int_0^L \frac{M(1)}{EI} dx \\ &= -\frac{FL^2}{2EI} + \frac{ML}{EI} \end{aligned}$$

Since $\theta = 0$,

$$M = \frac{FL}{2} \quad \text{and} \quad F = \frac{12EI}{L^2} u = ku$$

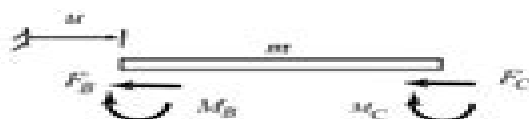


Figure 3

$$\sum F_x = m\ddot{u}$$

From the free-body diagram in Fig. 3,

$$-F_B - F_C = -\frac{12EI}{L^2} u - \frac{12EI}{L^2} u = m\ddot{u}$$

$$m\ddot{u} + \frac{24EI}{L^2} u = 0$$

Ans. (a)

(b) How would the equation of motion differ if the left-hand column had a stiffness $2EI$, with no other changes to the structure?

$$-F_B - F_C = -\frac{12(2EI)}{L^2} u - \frac{12EI}{L^2} u = m\ddot{u}$$

$$m\ddot{u} + \frac{36EI}{L^2} u = 0$$

Ans. (b)

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Lingjun Ying



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lecturers in engineering disciplines and engineering graduates The Shock and Vibration Digest ,1989-07 **Structural Dynamics** Harry Grundmann, Gerhart I. Schuëller, 2002 The proceedings contain contributions presented by authors from more than 30 countries at EURO DYN 2002 The proceedings show recent scientific developments as well as practical applications they cover the fields of theory of vibrations nonlinear vibrations stochastic dynamics vibrations of structured elements wave propagation and structure borne sound including questions of fatigue and damping Emphasis is laid on vibrations of bridges buildings railway structures as well as on the fields of wind and earthquake engineering respectively Enriched by a number of keynote lectures and organized sessions the two volumes of the proceedings present an overview of the state of the art of the whole field of structural dynamics and the tendencies of its further development **COSMIC** United States. National Aeronautics and Space Administration, 1977 **EARTHQUAKE RESISTANT DESIGN OF STRUCTURES** AGRAWAL, PANKAJ ,SHRIKHANDE, MANISH ,2006-01-01 This comprehensive and well organized book presents the concepts and principles of earthquake resistant design of structures in an easy to read style The use of these principles helps in the implementation of seismic design practice The book adopts a step by step approach starting from the fundamentals of structural dynamics to application of seismic codes in analysis and design of structures The text also focusses on seismic evaluation and retrofitting of reinforced concrete and masonry buildings The text has been enriched with a large number of diagrams and solved problems to reinforce the understanding of the concepts Intended mainly as a text for undergraduate and postgraduate students of civil engineering this text would also be of considerable benefit to practising engineers architects field engineers and teachers in the field of earthquake resistant design of structures **Scientific and Technical Aerospace Reports** ,1995 Computational Methods in Stochastic Dynamics Manolis Papadrakakis, George Stefanou, Vissarion Papadopoulos, 2012-09-26 The considerable influence of inherent uncertainties on structural behavior has led the engineering community to recognize the importance of a stochastic approach to structural problems Issues related to uncertainty quantification and its influence on the reliability of the computational models are continuously gaining in significance In particular the problems of dynamic response analysis and reliability assessment of structures with uncertain system and excitation parameters have been the subject of continuous research over the last two decades as a result of the increasing availability of powerful computing resources and technology This book is a follow up of a previous book with the same subject ISBN 978 90 481 9986 0 and focuses on advanced computational methods and software tools which can highly assist in tackling complex problems in stochastic dynamic seismic analysis and design of structures The selected chapters are authored by some of the most active scholars in their respective areas and represent some of the most recent developments in this field The book consists of 21 chapters which can be grouped into several thematic topics including dynamic analysis of stochastic systems reliability based design structural control and health monitoring model updating system identification wave propagation in random media seismic fragility analysis and damage assessment This edited book is primarily intended

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Shock and Vibration Computer Programs Barbara Pilkey,1975

Blast Resistant Structures ,1986

Contact-impact Problems: Engineering report and user's manual Robert Leroy Taylor,1980

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Air Force Design Manual Nathan Mortimore Newmark,J. D. Hiltiwanger,1962

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at 24 1 c in a calorimeter the temperature increases to 25 2 c as agcl s forms assuming the specific heat of the solution and
products is 4 20 j g c calculate the approximate amount of heat in joules produced

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c and the change in temperature is 50 c 20 c 30 c plugging these values into the equation we get $q = 75.0 \text{ g} \times 1 \text{ cal/g} \times 30 \text{ c} = 2250$
cal therefore 2250 cal is the correct answer rate this question 2 2

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