5.44

mass of tup: 2000 kg.
mass of frame: 20000 kg.
mass of anvil: 30000 kg.
mass of foundation block: 65000 kg.
stiffness of elastic pad: 1 GPa.
stiffness of isolation: 500 MPa.
striking velocity of tup: 4.5 m/s.

m_2 $m_2 = 50000$ kg

$k_2 = 1$ GPa

m_1 $m_1 = 65000$ kg

$k_1 = 500$ MPa

Solution:

(a) Natural frequencies of the system:
From problem 5.1,

$$\omega_{1,2}^2 = \frac{k_1 + k_2}{2\,m_1} + \frac{k_2}{2\,m_2} \mp \sqrt{\frac{1}{4}\left(\frac{k_1 + k_2}{m_1} + \frac{k_2}{m_2}\right)^2 - \frac{k_1\,k_2}{m_1\,m_2}}$$

$$\omega_{1,2}^2 = \frac{1.5 \times 10^9}{130000} + \frac{10^9}{100000} \mp \sqrt{\frac{1}{4}\left(\frac{1.5 \times 10^9}{65000} + \frac{10^9}{50000}\right)^2 - \frac{500 \times 10^{15}}{3.25 \times 10^9}}$$

or $\omega_1 = 62.6894$ rad/sec.
      $\omega_2 = 197.8559$ rad/sec.

(b) Initial conditions of the system:

Let ϑ_2 = initial velocity of anvil and frame just after the impact of tup.

From conservation of momentum principle, momentum of tup plus momentum of m_2 just before impact = momentum of tup plus momentum of m_2 just after impact.

i.e. $m_{tup}\,\vartheta_{tup} + m_2\,(0) = m_{tup}\,\vartheta_0 + m_2\,\vartheta_2$ (E$_1$)

where ϑ_0 = velocity of rebound of tup after impact
Also,

$$\text{Coefficient of restitution (e)} = \left(\frac{\text{relative velocity after impact}}{\text{relative velocity before impact}}\right)$$

i.e. $e = \dfrac{\vartheta_2 - \vartheta_0}{\vartheta_{tup}}$ or $\vartheta_0 = \vartheta_2 - e\,\vartheta_{tup}$ (E$_2$)

From Eqs. (E$_1$) and (E$_2$),

$$\vartheta_2 = \frac{m_{tup}\,\vartheta_{tup}\,(1 + e)}{m_{tup} + m_2}$$

For given data,

$$\vartheta_2 = \frac{2000\,(-4.5)\,(1 + 0.5)}{2000 + 50000} = -0.2596 \text{ m/s}$$

∴   Initial conditions are:

$x_1\,(0) = 0,$ $\dot{x}_1\,(0) = 0,$ $x_2\,(0) = 0,$ $\dot{x}_2\,(0) = -0.2596$ m/s.

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Robert Francis Steidel,Steidel

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    - The Rise of Digital Reading Mechanical Vibrations Rao 4th Edition Solution Manual
    - Advantages of eBooks Over Traditional Books
2. Identifying Mechanical Vibrations Rao 4th Edition Solution Manual
    - Exploring Different Genres
    - Considering Fiction vs. Non-Fiction
    - Determining Your Reading Goals
3. Choosing the Right eBook Platform
    - Popular eBook Platforms
    - Features to Look for in an Mechanical Vibrations Rao 4th Edition Solution Manual
    - User-Friendly Interface

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web calculate the mass percent mole fraction molality and molarity of hexane c 6 h 14 d 0 660 g cm 3 when it is mixed with heptane c 7 h 12 d 0 684 g cm3 in a 35 0 55 0 ml ratio assume that the volumes are additive

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web notice that the mole fraction has no units on it and is written as a decimal value do not change it to percent note of caution you could see the term mole percent it is simply the mole fraction mltiplied by 100 for example in the problem just below the mole fraction of cinnamic acid is 0 2885 its mole percent would be 28 85

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web since the mole fraction of the o 2 is 0 050 it contributes 0 050 or if you will 5 0 of the total pressure thus total pressure is 0 21 0 050 4 2 atm problem 9 a sample of 1 43 g of helium and an unweighed quantity of o 2 are mixed in a flask at room temperature