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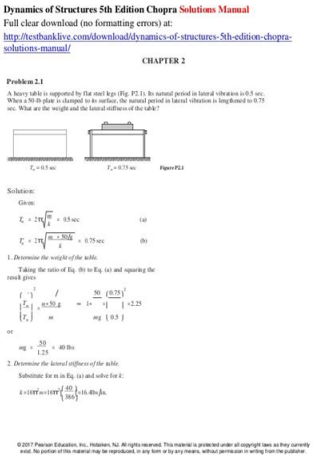

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CHAPTER 2

Problem 2.1

A heavy table is supported by flat steel legs (Fig. P2.1). Its natural period in lateral vibration is 0.5 sec. When a 50-lb plate is clamped to its surface, the natural period in lateral vibration is lengthened to 0.75 sec. What are the weight and the lateral stiffness of the table?

Solution:

Given:

$$T_n = 2\pi\sqrt{\frac{m}{k}} = 0.5 \text{ sec} \quad \text{(a)}$$

$$T_n' = 2\pi\sqrt{\frac{m+50/g}{k}} = 0.75 \text{ sec} \quad \text{(b)}$$

1. *Determine the weight of the table.*

Taking the ratio of Eq. (b) to Eq. (a) and squaring the result gives

$$\left(\frac{T_n'}{T_n}\right)^2 = \frac{m+50/g}{m} = 1 + \frac{50}{mg}\left(\frac{0.75}{0.5}\right)^2 = 2.25$$

or

$$mg = \frac{50}{1.25} = 40 \text{ lbs}$$

2. *Determine the lateral stiffness of the table.*

Substitute for m in Eq. (a) and solve for k:

$$k = 4\pi^2 m = 16\pi^2\left(\frac{40}{386}\right) = 16.4 \text{ lb/in.}$$

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