Given: $m = 250 \, kg$ $k = 105 \, N/m$ Unknown: b

Task: Determine b for Under, Critical and Over dampened Systems

Solution: Standard Equation for dampened harmonic motion:

$$m\ddot{x} + b\dot{x} + k = 0$$

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Characteristic Equation

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$$r^2 + \frac{b}{m}r + \frac{k}{m} = 0 \qquad \text{Substitute values}$$

$$r^2 + \frac{b}{250}r + \frac{105}{250} = 0$$

$$r^2 + \frac{b}{250}r + \frac{21}{50} = 0 \qquad\Bigg\} \qquad r = b^2 - 4ac$$

$$r = b^2 - 4ac \qquad\qquad r = 0 \quad \text{critically dampened}$$

set r=0

$$0 = \left(\frac{b}{250}\right)^2 - 4\left(\frac{21}{50}\right) \qquad r < 0 \quad \text{under dampened}$$

$$r > 0 \quad \text{over dampened}$$

$$\frac{b^2}{62500} = 1.68 \qquad\qquad b = 324 \, Ns/m \quad \text{critical}$$

$$b ≈ 324 \, Ns/m \qquad\qquad b < 324 \, Ns/m \quad \text{under dampened}$$

$$b > 324 \, Ns/m \quad \text{over dampened}$$

Slight overdamping would be okay but for a Camera system critical damperny would be better