Differential Equations

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CHAPTER 1

Chapter

1. Section

PROBLEM 1.1. Let m, b, and k be a positive constant such that $b^2 - 4mk < 0$. Consider an underdamped oscillatior with sinusoidal driving force

$$m\ddot{x} + b\dot{x} + kx = A\sin\omega t, \qquad x(0) = x_0,\ \dot{x}(0) = 0.$$

For convenience, define positive constants $\beta := \frac{b}{2m}$, $\omega_0 := \sqrt{\frac{k}{m}}$, and $\omega_1 := \sqrt{\omega_0^2 - \beta^2}$.

The solution of this equation when $A = 0$ is called the complementary solution and is given by

$$x_c(t) = x_0 e^{-\beta t}\cos\omega_1 t.$$

(1)

(2) Find the value of ω such that the amplitude of particular solution is maximized.