MA 266 Lecture 20

Section 3.7 Mechanic and Electrical Vibrations (contd)

Review For undamped free vibrations, the governing equation is

Example 1. ***(Problem 6)*** *A mass of 100 g stretches a spring* $5cm$*. If the mass is set in motion from its equilibrium position with a downward velocity of 10 cm/s, and if there is no damping, determine the position* u *of the mass at any time* t*. When does the mass first return to its equilibrium position?*

Damped Free Vibrations

If we include the effect of damping, the differential equation the motion becomes

Depending the sign of $\gamma^2 - 4km$ the solution u has one of the following forms

- if $\gamma^2 - 4km > 0$

- if $\gamma^2 - 4km = 0$

- if $\gamma^2 - 4km < 0$

Remark

The case where $\gamma^2 - 4km < 0$ is of most interest. The solution can be written as

Example 2. ***(Problem 10)*** *A mass weighing 16lb stretches a spring 3in. The mass is attached to a viscous damper with a damping constant of 2 lb·s/ft. If the mass is set in motion from its equilibrium position with a downward velocity of 3 in/s, find its position u at any time t. Determine when the mass first returns to its equilibrium position.*