MATH 319, Fall 2013, Assignment 7

Textbook Questions

Section 3.7, **#1** Write $u = 3\cos 2t + 4\sin 2t$ in the form $R\cos(\omega_0 t - \delta)$.

#4 Write $u = -2\cos \pi t - 3\sin \pi t$ in the form $R\cos(\omega_0 t - \delta)$.

#11 A spring is stretched 10 cm by a force of 3 N. A mass of 2 kg is hung from the spring and is also attached to a viscous damper that exerts a force of 3 N when the velocity of the mass is 5 m/s. If the mass is pulled down 5 cm below its equilibrium position and given an initial downward velocity of 10 cm/s, determine its position u at any time t. Find the quasi frequency μ and the ratio of μ to the natural frequency of the corresponding undamped motion.

Section 3.8, **#1** Write $\cos 9t - \cos 7t$ as a product of two trigonometric functions of different frequencies.

#12 A spring-mass system has a spring constant of 3 N/m. A mass of 2 kg is attached to the spring, and the motion takes place in a viscous fluid that offers a resistance numerically equal to the magnitude of the instantaneous velocity. If the system is driven by an external force of $(3\cos 3t - 2\sin 3t)$ N, determine the steady state response. Express your answer in the form $R\cos(\omega t - \delta)$.

#15 Find the solution of the initial value problem

$$u'' + u = F(t), \quad u(0) = 0, u'(0) = 0$$

where

$$F(t) = \begin{cases} F_0 t, & 0 \le t \le \pi \\ F_0(2\pi - t), & \pi < t \le 2\pi \\ 0, & 2\pi < t. \end{cases}$$

Hint: Treat each time interval separately, and match the solutions in the different intervals by requiring u and u' to be continuous functions of t.