

所 別：工程技術研究所
學程別：自動化及控制學程

組別：甲組、丙組

科目：工程數學

1. Solve (15%)

$$\frac{d^2x}{dt^2} + 10x - 4y = 0$$

$$-4x + \frac{d^2y}{dt^2} + 4y = 0$$

$$\text{subject to } x(0) = 0, \frac{dx(0)}{dt} = 1, y(0) = 0, \frac{dy(0)}{dt} = -1.$$

2. Solve the nonhomogeneous equation (15%)

$$x^2y'' - 3xy' + 3y = 2x^4e^x.$$

3. Find the solution $u(x,t)$ of the problem (20%)

$$\text{Differential equation } u_t = Ku_{xx}, \quad 0 < x < L, t > 0$$

$$\text{Boundary conditions } u_x(0,t) = 0, \quad u_x(L,t) = 0, \quad t > 0$$

$$\text{Initial condition } u(x,0) = f(x), \quad 0 < x < L.$$

4. Find the eigenvalues and eigenvectors of (15%)

$$A = \begin{bmatrix} 9 & 1 & 1 \\ 1 & 9 & 1 \\ 1 & 1 & 9 \end{bmatrix}.$$

5. Evaluate $\iint_R xy \, dA$ over the region R as shown. (15%)

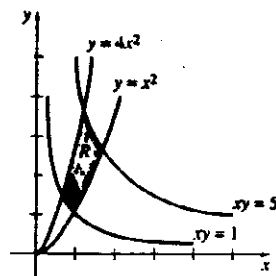


Fig. 5.

6. The period excitation shown is applied to the base of a punch press. Determine the resulting motion. (20%)

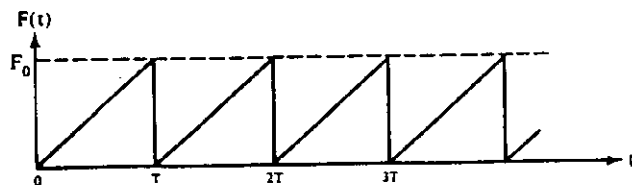
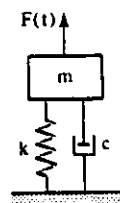


Fig. 6.