工程力學

Problem #1 (15 %)

1) As shown in Figure 1, a particle (with mass = m , speed = Vp) hits a rod (with length = L, mass = 2m). Under plastic impact (i.e. the particle will stay with the rod after the hit), what is the speed of the center of the rod just after impact ?
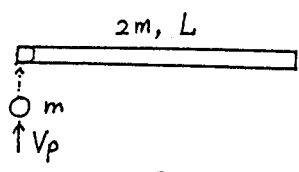

Figure 1

Problem #2 (15 %)

2) For a mass-spring arrangement shown in Figure 2, where point B is a pinned support. Find :
    a) the corresponding equations of motion,
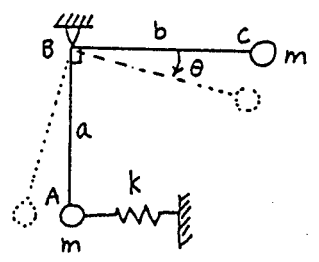   b) the natural frequency of the system.

Figure 2

Problem #3 (10 %)

3) An axisymmetric satellite is spinning at a constant body rate , $\omega_z = \Omega$, with the moment of inertia, I, where
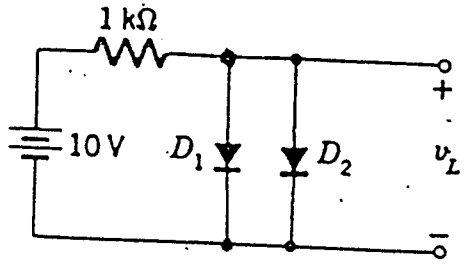
$$I = \begin{bmatrix} A & 0 & 0 \\ 0 & A & 0 \\ 0 & 0 & C \end{bmatrix}$$

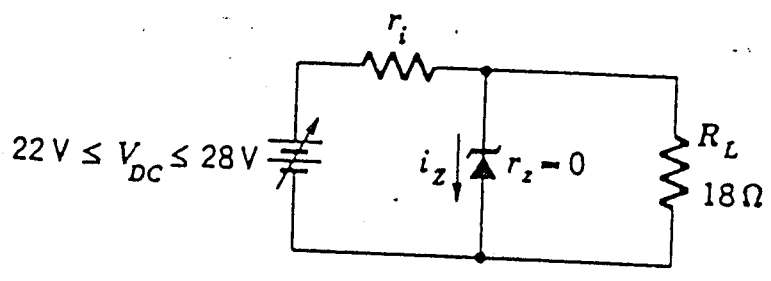Describe the motion of the satellite under torque-free situation.

電子電路

4) 圖三之二極體電路, 若二極體 D_1 及 D_2 的特性如下式, 求 v_L. (10%)

$$i_{D_1} = \begin{cases} 2\times10^{-3}\,v_{D_1}, & v_{D_1} \geq 0 \\ 0, & v_{D_1} < 0 \end{cases} \quad 及 \quad i_{D_2} = \begin{cases} 3\times10^{-3}\,v_{D_2}, & v_{D_2} \geq 0 \\ 0, & v_{D_2} < 0 \end{cases}$$

圖三

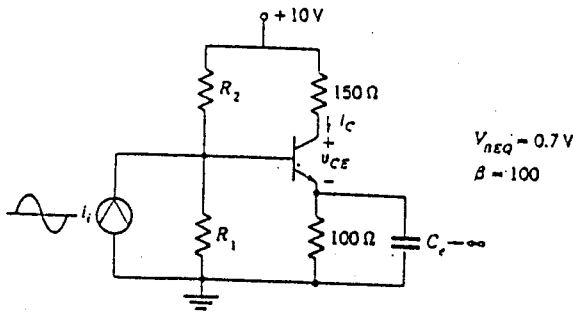5) 圖四中之直流供應電壓將在 $22V$ 及 $28V$ 之間變動, 若曾納二極體(Zener diode)在 $200\,mA < i_z \leq 2A$ 時, 其端電壓可保持在 $18V$. 則 (a) 求一適當的 r_i 以使 R_L 兩端之電壓保持在 $18V$, 及 (b) 求二極體的最大功率損耗. (15%)
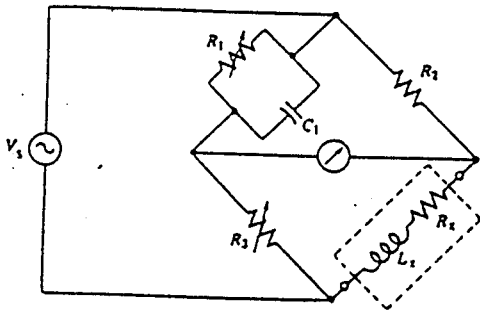

圖四

6) 對於圖五之電路, (a) 求集極電流之最大對稱擺動值及對應之Q點, (b) 求達成此Q點設計所須之 R_1 及 R_2, (c) 電容 C_e 之作用為何? (15%)

圖五

7) 圖六的交流電橋, 若 $R_1 = 250k\Omega, R_2 = 1k\Omega, R_3 = 5k\Omega$ 及 $C_1 = 2000\mu F$, 求電橋平衡時的 R_x 及 L_x . (10%)

圖六

8) 回答下列問題: (a) 以 AND, OR 及 NOT 邏輯元件, 繪一半加器 (c)試繪一達靈頓放大器. (10%)