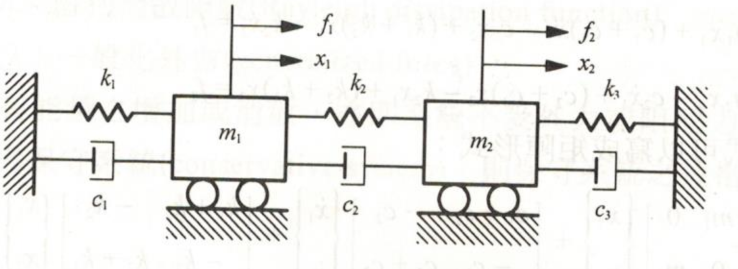
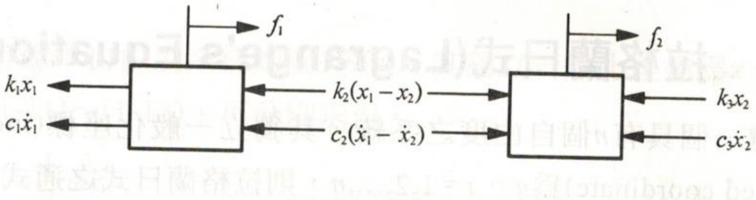
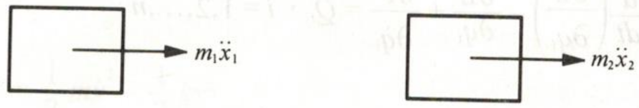


(a)系統圖



(b)外力平衡圖



(c)慣性力圖

圖1-10　雙自由度系統外力平衡及慣性力圖

解：首先定義兩個集中質塊之自由度爲x_1及x_2，向右爲正，再分別畫外力平衡圖及慣性力如圖1-10(b)及1-10(c)，代入式(1-9)

m_1集中質塊：

$$m_1\ddot{x}_1=f_1-k_1x_1-c_1\dot{x}_1-k_2(x_1-x_2)-c_2(\dot{x}_1-\dot{x}_2) \qquad \text{(a)}$$

m_2集中質塊：

$$m_2\ddot{x}_2=f_2+k_2(x_1-x_2)+c_2(\dot{x}_1-\dot{x}_2)-k_3x_2-c_3\dot{x}_2 \qquad \text{(b)}$$

整理上二式得系統運動方程式如下：

$$m_1\ddot{x}_1+(c_1+c_2)\dot{x}_1-c_2\dot{x}_2+(k_1+k_2)x_1-k_2x_2=f_1 \qquad \text{(c)}$$

$$m_2\ddot{x}_2-c_2\dot{x}_1+(c_2+c_3)\dot{x}_2-k_2x_1+(k_2+k_3)x_2=f_2 \qquad \text{(d)}$$

上二式可以寫成矩陣形式：

$$\begin{bmatrix} m_1 & 0 \\ 0 & m_2 \end{bmatrix}\begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix}+\begin{bmatrix} c_1+c_2 & -c_2 \\ -c_2 & c_2+c_3 \end{bmatrix}\begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix}+\begin{bmatrix} k_1+k_2 & -k_2 \\ -k_2 & k_2+k_3 \end{bmatrix}\begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix}=\begin{Bmatrix} f_1 \\ f_2 \end{Bmatrix} \qquad \text{(e)}$$

SECTION 11.2. Functions of Any Period $p = 2L$, page 487

Purpose. It is practical to start with functions of period 2π, as we have done, because in this case the Euler formulas and Fourier series look much simpler. And this is practically no detour because the general case of $p = 2L$ is obtained simply by a linear transformation on the x-axis, giving the Fourier series (5) with coefficients (6).

The notation $p = 2L$ is suggested by the fact that we shall later use **half-range expansions,** with the series used "physically" only on an interval from $x = 0$ to L (the extension of a vibrating string or a beam in heat conduction problems, etc.).

SECTION 11.3. Even and Odd Functions. Half-Range Expansions, page 490

Purpose. 1. To show that a Fourier series of an even function (an odd function) has only cosine terms (only sine terms), so that unnecesary work and sources of errors are avoided.

2. To represent a function $f(x)$ by a Fourier cosine series or by a Fourier sine series (of period $2L$) if $f(x)$ is given on an interval $0 \leqq x \leqq L$ only, which is half the interval of periodicity—hence the name "half-range."

Comment

Such half-range expansions occur in vibrational problems, heat problems, etc., as will be shown in Chap. 12.