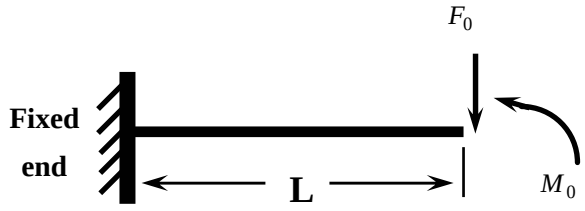
程式 74　Derivation of beam stiffness using BEM



Governing equation:

$$\frac{d^4u(x)}{dx^4}=0,\quad 0<x<L$$

Boundary conditions:

$$u(0)=0,\quad \theta(0)=0$$
$$m(L)=M_0,\quad v(L)=F_0$$

(1) $u(x)=\left\{-U(s,x)v(s)+\Theta(s,x)m(s)-M(s,x)\theta(s)+V(s,x)u(s)\right\}\Big|_{s=0}^{s=1}$

(2) $\theta(x)=\left\{-U_\theta(s,x)v(s)+\Theta_\theta(s,x)m(s)-M_\theta(s,x)\theta(s)+V_\theta(s,x)u(s)\right\}\Big|_{s=0}^{s=1}$

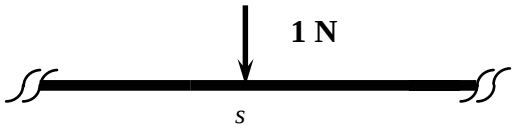
(3) $m(x)=\left\{-U_m(s,x)v(s)+\Theta_m(s,x)m(s)-M_m(s,x)\theta(s)+V_m(s,x)u(s)\right\}\Big|_{s=0}^{s=1}$

(4) $v(x)=\left\{-U_v(s,x)v(s)+\Theta_v(s,x)m(s)-M_v(s,x)\theta(s)+V_v(s,x)u(s)\right\}\Big|_{s=0}^{s=1}$

Methods	Group
(1), (2)	杜堅瑋、郭鍠輝、賴明謙
(1), (3)	沈文成、蕭嘉俊、陳佳聰
(1), (4)	徐銘謄、鄭傑元、洪慶銘
(2), (3)	吳炳承、陳弘茂、吳佳林
(2), (4)	林永倫、林騰威、江銘祥
(3), (4)	李應德、吳清森、陳正宗

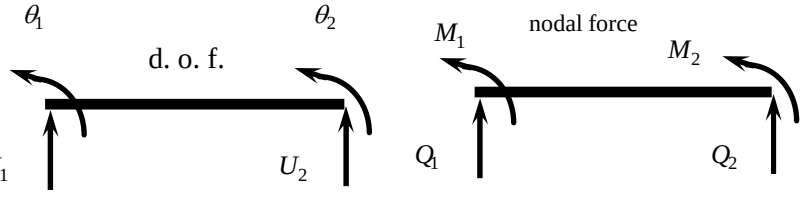
1. Use any two equations of Eqs.(1)~(4) and derive the beam stiffness.
2. Solve the cantilever case subject to end moment and shear.

I. Derive the fundamental solution



II. Derive the stiffness matrix by BEM

$$\frac{EI}{L^3}\begin{bmatrix}12 & 6L & -12 & 6L\\ 6L & 4L^2 & -6L & 2L^2\\ -12 & -6L & 12 & -6L\\ 6L & 2L^2 & -6L & 4L^2\end{bmatrix}\begin{bmatrix}U_1\\ \theta_1\\ U_2\\ \theta_2\end{bmatrix}=\begin{bmatrix}Q_1\\ M_1\\ Q_2\\ M_2\end{bmatrix}$$



III. Solve the problem by BEM