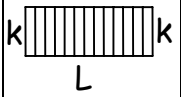
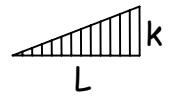
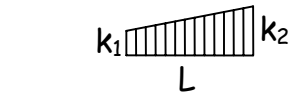

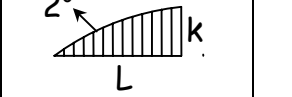

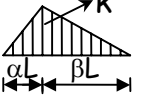
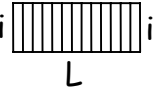
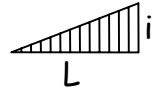
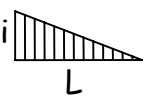
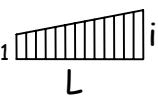

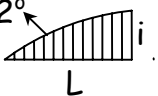
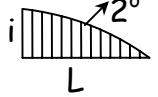
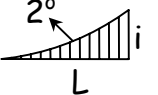
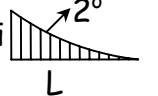
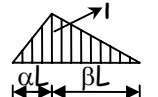
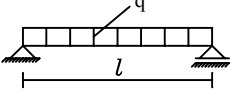
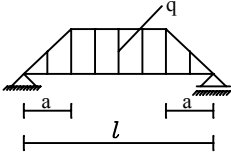
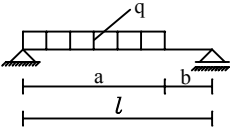
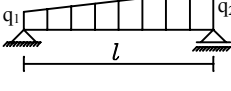
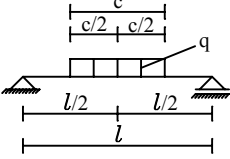
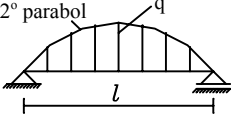
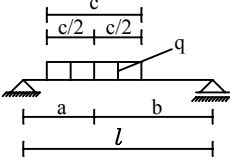
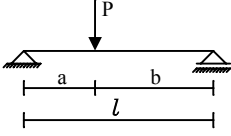
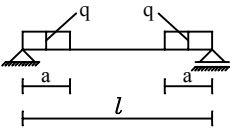
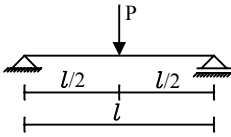
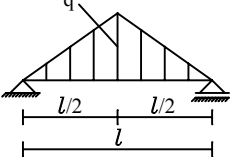
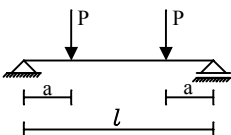
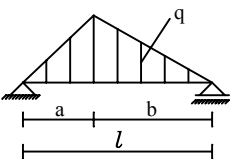
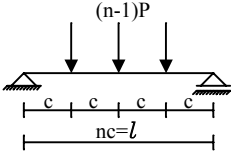
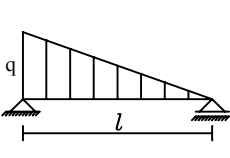
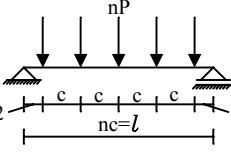
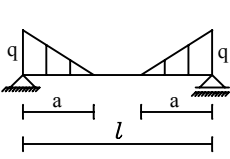
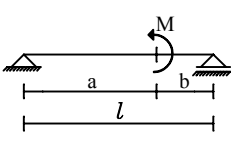


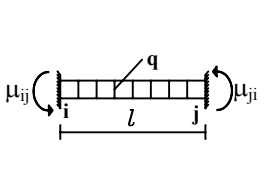
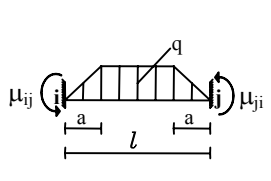
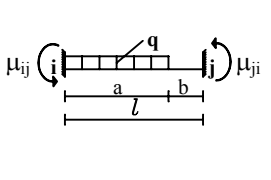
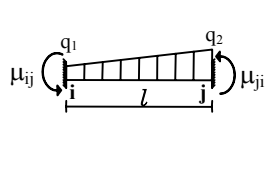
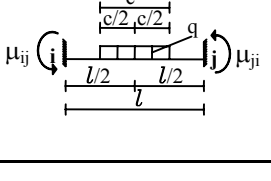
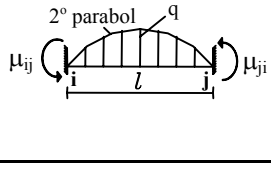
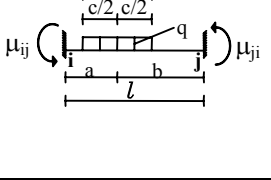
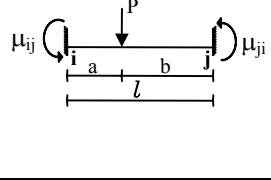
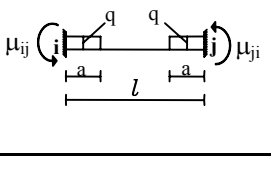
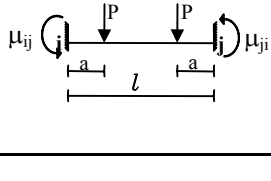
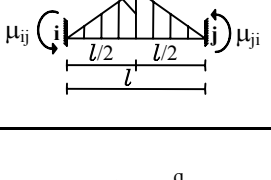
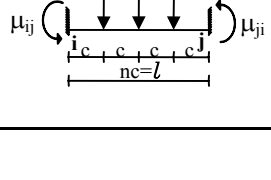
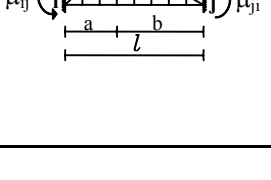
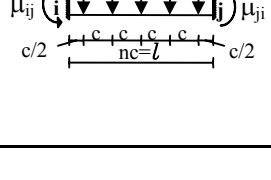
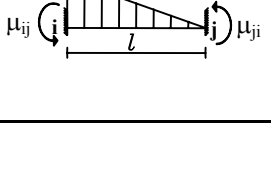
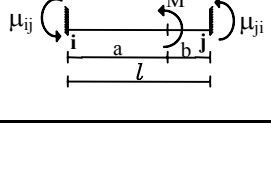
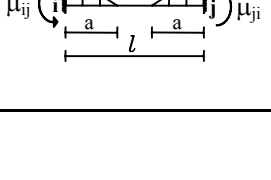
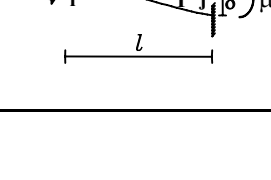
ÇARPIM TABLOSU ($\int_0^L M_1 \cdot M_2 ds$)

							
	Lik	$\frac{1}{2}Lik$	$\frac{1}{2}Li(k_1 + k_2)$	$\frac{2}{3}Lik_m$	$\frac{2}{3}Lik$	$\frac{1}{3}Lik$	$\frac{1}{2}Lik$
	$\frac{1}{2}Lik$	$\frac{1}{3}Lik$	$\frac{1}{6}Li(k_1 + 2k_2)$	$\frac{1}{3}Lik_m$	$\frac{5}{12}Lik$	$\frac{1}{4}Lik$	$\frac{1}{6}L(1 + \alpha)ik$
	$\frac{1}{2}Lik$	$\frac{1}{6}Lik$	$\frac{1}{6}Li(2k_1 + k_2)$	$\frac{1}{3}Lik_m$	$\frac{1}{4}Lik$	$\frac{1}{12}Lik$	$\frac{1}{6}L(1 + \beta)ik$
	$\frac{1}{2}L(i_1 + i_2)k$	$\frac{1}{6}L(i_1 + 2i_2)k$	$\frac{1}{6}L(2i_1k_1 + i_1k_2 + i_2k_1 + 2i_2k_2)$	$\frac{1}{3}L(i_1 + i_2)k_m$	$\frac{1}{12}L(3i_1 + 5i_2)k$	$\frac{1}{12}L(i_1 + 3i_2)k$	$\frac{1}{6}Lk[(1 + \beta)i_1 + (1 + \alpha)i_2]$
	$\frac{2}{3}Li_mk$	$\frac{1}{3}Li_mk$	$\frac{1}{3}Li_m(k_1 + k_2)$	$\frac{8}{15}Li_mk_m$	$\frac{7}{15}Li_mk$	$\frac{1}{5}Li_mk$	$\frac{1}{3}L(1 + \alpha\beta)i_mk$
	$\frac{2}{3}Lik$	$\frac{5}{12}Lik$	$\frac{1}{12}Li(3k_1 + 5k_2)$	$\frac{7}{15}Lik_m$	$\frac{8}{15}Lik$	$\frac{3}{10}Lik$	$\frac{1}{12}L(5 - \beta - \beta^2)ik$
	$\frac{2}{3}Lik$	$\frac{1}{4}Lik$	$\frac{1}{12}Li(5k_1 + 3k_2)$	$\frac{7}{15}Lik_m$	$\frac{11}{30}Lik$	$\frac{2}{15}Lik$	$\frac{1}{12}L(5 - \alpha - \alpha^2)ik$
	$\frac{1}{3}Lik$	$\frac{1}{4}Lik$	$\frac{1}{12}Li(k_1 + 3k_2)$	$\frac{1}{5}Lik_m$	$\frac{3}{10}Lik$	$\frac{1}{5}Lik$	$\frac{1}{12}L(1 + \alpha + \alpha^2)ik$
	$\frac{1}{3}Lik$	$\frac{1}{12}Lik$	$\frac{1}{12}Li(3k_1 + k_2)$	$\frac{1}{5}Lik$	$\frac{2}{15}Lik$	$\frac{1}{30}Lik$	$\frac{1}{12}L(1 + \beta + \beta^2)ik$
	$\frac{1}{2}Lik$	$\frac{1}{6}L(1 + \alpha)ik$	$\frac{1}{6}Li[(1 + \beta)k_1 + (1 + \alpha)k_2]$	$\frac{1}{3}L(1 + \alpha\beta)ik_m$	$\frac{1}{12}L(5 - \beta - \beta^2)ik$	$\frac{1}{12}L(1 + \alpha + \alpha^2)ik$	$\frac{1}{3}Lik$

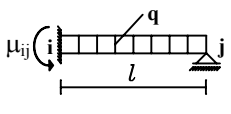
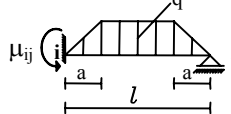
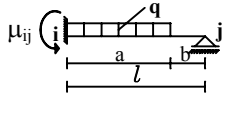
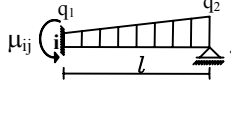
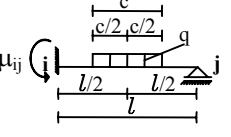
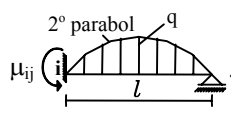
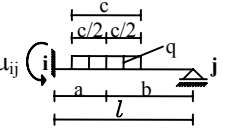
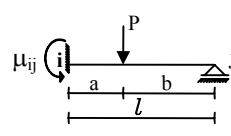
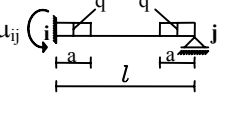
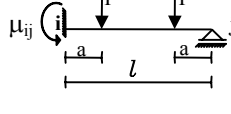
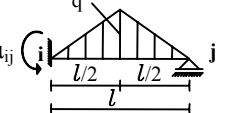
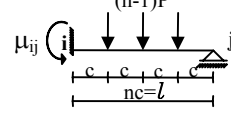
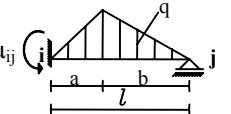
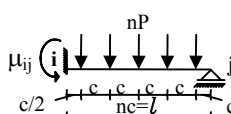
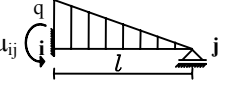
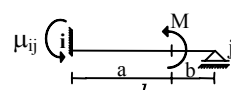
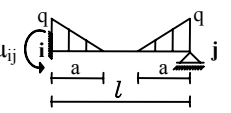
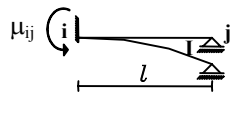
YÜK TERİMLERİ TABLOSU

Yük	L,R	Yük	L,R
	$L = R = \frac{ql^2}{4}$		$L = R = \frac{q}{4} \left[l^2 - a^2 \left(2 - \frac{a}{l} \right) \right]$
	$L = \frac{qa^2}{4} \left(2 - \frac{a}{l} \right)^2$ $R = \frac{qa^2}{4} \left(2 - \frac{a^2}{l^2} \right)$		$L = \frac{l^2}{60} (8q_1 + 7q_2)$ $R = \frac{l^2}{60} (7q_1 + 8q_2)$
	$L = R = \frac{qc}{8l} (3l^2 - c^2)$		$L = R = \frac{ql^2}{5}$
	$L = \frac{qbc}{l^2} \left(l^2 - b^2 - \frac{c^2}{4} \right)$ $R = \frac{qac}{l^2} \left(l^2 - a^2 - \frac{c^2}{4} \right)$		$L = \frac{Pab(b+l)}{l^2}$ $R = \frac{Pab(a+l)}{l^2}$
	$L = R = \frac{qa^2}{2l} (3l - 2a)$		$L = R = \frac{3}{8} Pl$
	$L = R = \frac{5}{32} ql^2$		$L = R = 3Pa \left(1 - \frac{a}{l} \right)$
	$L = \frac{ql^2}{60} \left(1 + \frac{b}{l} \right) \left(7 - 3 \frac{b^2}{l^2} \right)$ $R = \frac{ql^2}{60} \left(1 + \frac{a}{l} \right) \left(7 - 3 \frac{a^2}{l^2} \right)$		$L = R = Pl \frac{n}{4} \left(1 - \frac{1}{n^2} \right)$ n: tek sayı
	$L = \frac{8}{60} ql^2$ $R = \frac{7}{60} ql^2$		$L = R = Pl \frac{n}{4} \left(1 + \frac{1}{2n^2} \right)$ n: tek sayı
	$L = R = \frac{qa^2}{4l} (2l - a)$		$L = M \left(1 - \frac{3b^2}{l^2} \right)$ $R = M \left(\frac{3a^2}{l^2} - 1 \right)$

ANKASTRELİK MOMENTLERİ TABLOSU

Yük	Ankastrelilik Momentleri	Yük	Ankastrelilik Momentleri
	$\mu_{ij} = \frac{ql^2}{12}$ $\mu_{ji} = -\frac{ql^2}{12}$		$\mu_{ij} = \frac{q}{12} \left[l^2 - a^2 \left(2 - \frac{a}{l} \right) \right]$ $\mu_{ji} = -\frac{q}{12} \left[l^2 - a^2 \left(2 - \frac{a}{l} \right) \right]$
	$\mu_{ij} = \frac{qa^2}{4} \left[2 - \frac{a}{l} \left(\frac{8}{3} - \frac{a}{l} \right) \right]$ $\mu_{ji} = -\frac{qa^3}{12l^2} (4l - 3a)$		$\mu_{ij} = \frac{l^2}{60} (3q_1 + 2q_2)$ $\mu_{ji} = -\frac{l^2}{60} (2q_1 + 3q_2)$
	$\mu_{ij} = \frac{qc}{24l} (3l^2 - c^2)$ $\mu_{ji} = -\frac{qc}{24l} (3l^2 - c^2)$		$\mu_{ij} = \frac{ql^2}{15}$ $\mu_{ji} = -\frac{ql^2}{15}$
	$\mu_{ij} = \frac{qc}{12l^2} \left[(4l^2 - c^2)(2b - a) - 4(2b^3 - a^3) \right]$ $\mu_{ji} = -\frac{qc}{12l^2} \left[(4l^2 - c^2)(2a - b) - 4(2a^3 - b^3) \right]$		$\mu_{ij} = Pa \frac{b^2}{l^2} \quad \mu_{ji} = -Pb \frac{a^2}{l^2}$ <p>Özel hal: $a=b=\frac{l}{2}$, $\mu_{ij} = \frac{Pl}{8}$, $\mu_{ji} = -\frac{Pl}{8}$</p>
	$\mu_{ij} = \frac{qa^2}{6l} (3l - 2a)$ $\mu_{ji} = -\frac{qa^2}{6l} (3l - 2a)$		$\mu_{ij} = \frac{Pa}{l} (l - a)$ $\mu_{ji} = -\frac{Pa}{l} (l - a)$
	$\mu_{ij} = \frac{5}{96} ql^2$ $\mu_{ji} = -\frac{5}{96} ql^2$		$\mu_{ij} = \frac{PL}{12} \left(n - \frac{1}{n} \right)$ $\mu_{ji} = -\frac{PL}{12} \left(n - \frac{1}{n} \right)$
	$\mu_{ij} = \frac{q}{180l} \left[7l^3 - 7l^2(a - 2b) + 3(a^2 - 2b^2) + 3(a^3 - 2b^3) \right]$ $\mu_{ji} = -\frac{q}{180l} \left[7l^3 + 7l^2(2b - a) - 3(2a^2 - b^2) - 3(2a^3 - b^3) \right]$		$\mu_{ij} = \frac{PL}{12} \left(n + \frac{1}{2n} \right)$ $\mu_{ji} = -\frac{PL}{12} \left(n + \frac{1}{2n} \right)$
	$\mu_{ij} = \frac{ql^2}{20}$ $\mu_{ji} = -\frac{ql^2}{30}$		$\mu_{ij} = M \frac{a}{l} \left(4 - 3 \frac{a}{l} - \frac{l}{a} \right)$ $\mu_{ji} = -M \frac{a}{l} \left(3 \frac{a}{l} - 2 \right)$
	$\mu_{ij} = \frac{qa^2}{12l} (2l - a)$ $\mu_{ji} = -\frac{qa^2}{12l} (2l - a)$		$\mu_{ij} = \frac{6EI}{l^2} \delta$ $\mu_{ji} = \frac{6EI}{l^2} \delta$

ANKASTRELİK MOMENTLERİ TABLOSU

Yük	Ankastrelilik Momentleri	Yük	Ankastrelilik Momentleri
	$\mu_{ij} = \frac{ql^2}{8}$		$\mu_{ij} = \frac{q}{8} \left[l^2 - a^2 \left(2 - \frac{a}{l} \right) \right]$
	$\mu_{ij} = \frac{qa^2}{8} \left(2 - \frac{a}{l} \right)^2$		$\mu_{ij} = \frac{l^2}{120} (8q_1 + 7q_2)$
	$\mu_{ij} = \frac{qc}{16l} (3l^2 - c^2)$		$\mu_{ij} = \frac{ql^2}{10}$
	$\mu_{ij} = \frac{qbc}{8l^2} [4(l^2 - b^2) - c^2]$		$\mu_{ij} = \frac{Pab(b+l)}{2l^2}$ Özel hal: $a=b=\frac{l}{2}$, $\mu_{ij} = \frac{3}{16} Pl$
	$\mu_{ij} = \frac{qa^2}{4l} (3l - 2a)$		$\mu_{ij} = \frac{3}{2} Pa \left(1 - \frac{a}{l} \right)$
	$\mu_{ij} = \frac{5}{64} ql^2$		$\mu_{ij} = \frac{PL}{8} \left(n - \frac{1}{n} \right)$
	$\mu_{ij} = \frac{ql}{120} (l+b) \left(7 - 3 \frac{b^2}{l^2} \right)$		$\mu_{ij} = \frac{PL}{8} \left(n + \frac{1}{2n} \right)$
	$\mu_{ij} = \frac{ql^2}{15}$		$\mu_{ij} = M \frac{a}{l} \left(3 - \frac{3a}{2l} - \frac{l}{a} \right)$
	$\mu_{ij} = \frac{qa^2}{8l} (2l - a)$		$\mu_{ij} = \frac{3EI}{l^2} \delta$

“i” ucu mafsallı, “j” ucu ankastre mesnet olması durumunda $\mu_{ij}=0$ olur. μ_{ji} ler ise “a” ankastre mesnetten olan uzaklığı göstermek üzere, yukarıdaki formüllerle bulunan değerlerin negatif işaretlisine eşittir.

DÜZLEM KAFES SİSTEMLER

Eleman eksen takımına göre eleman rijitlik matrisi

$$[k_i]_e = \frac{EA}{L} \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Genel eksen takımına göre eleman rijitlik matrisi

$$[K_i]_g = \frac{EA}{L} \begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

$$c = \cos \alpha \quad s = \sin \alpha$$

Dönüşüm Matrisi

$$[T_i] = \begin{bmatrix} \cos \alpha & \sin \alpha & 0 & 0 \\ -\sin \alpha & \cos \alpha & 0 & 0 \\ 0 & 0 & \cos \alpha & \sin \alpha \\ 0 & 0 & -\sin \alpha & \cos \alpha \end{bmatrix}$$

DÜZLEM ÇERÇEVE SİSTEMLER

Eleman eksen takımına göre eleman rijitlik matrisi

$$[k_i]_e = \begin{bmatrix} \frac{EA}{L} & 0 & 0 & -\frac{EA}{L} & 0 & 0 \\ 0 & \frac{12EI}{L^3} & \frac{6EI}{L^2} & 0 & -\frac{12EI}{L^3} & \frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{4EI}{L} & 0 & -\frac{6EI}{L^2} & \frac{2EI}{L} \\ -\frac{EA}{L} & 0 & 0 & \frac{EA}{L} & 0 & 0 \\ 0 & -\frac{12EI}{L^3} & -\frac{6EI}{L^2} & 0 & \frac{12EI}{L^3} & -\frac{6EI}{L^2} \\ 0 & \frac{6EI}{L^2} & \frac{2EI}{L} & 0 & -\frac{6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$

Genel eksen takımına göre eleman rijitlik matrisi

$$[K_i]_g = \begin{bmatrix} a & b & c & -a & -b & c \\ b & d & e & -b & -d & e \\ c & e & f & -c & -e & g \\ -a & -b & -c & a & b & -c \\ -b & -d & -e & b & d & -e \\ c & e & g & -c & -e & f \end{bmatrix}$$

$$a = \frac{EA}{L} \cos^2 \alpha + \frac{12EI}{L^3} \sin^2 \alpha \quad b = \left(\frac{EA}{L} - \frac{12EI}{L^3} \right) \cos \alpha \sin \alpha$$

$$c = -\frac{6EI}{L^2} \sin \alpha \quad d = \frac{EA}{L} \sin^2 \alpha + \frac{12EI}{L^3} \cos^2 \alpha$$

$$e = \frac{6EI}{L^2} \cos \alpha \quad f = \frac{4EI}{L}$$

$$g = \frac{2EI}{L}$$

Dönüşüm Matrisi

$$[T_i] = \begin{bmatrix} \cos \alpha & \sin \alpha & 0 & 0 & 0 & 0 \\ -\sin \alpha & \cos \alpha & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \cos \alpha & \sin \alpha & 0 \\ 0 & 0 & 0 & -\sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$