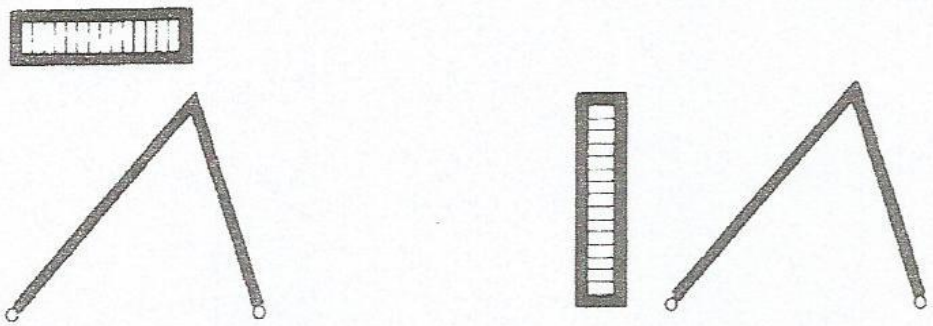
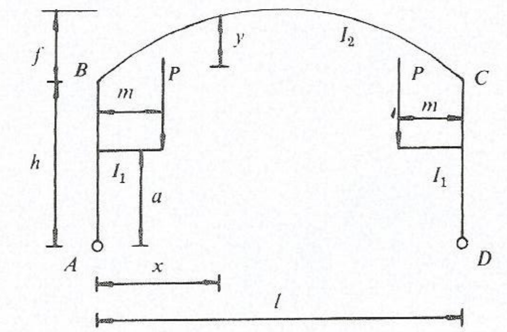
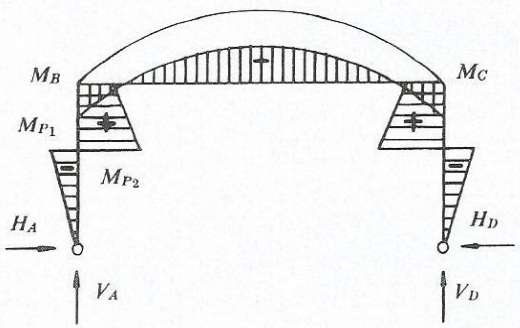
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRIANGULARES



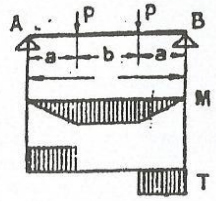
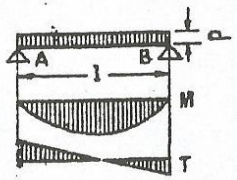
$$K = \frac{I_2}{I_1} \cdot \frac{S_1}{S_2}$$

300 (38T)

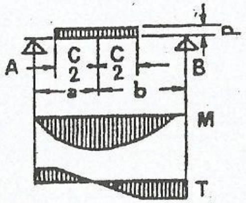
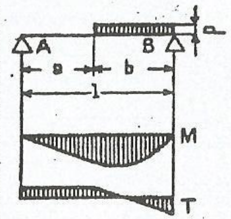
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = V_D = P$ $H_A = H_D = \dfrac{5Pm}{h} \cdot \dfrac{3k(h^2 - a^2) + h(2f + 3h)}{5h^2(2k + 3) + 4f(5h + 2f)}$
	**Momentos flectores:** $M_B = M_C = Pm - H_A \cdot h$ $M_{P_1} = - H_A \cdot a$ $M_{P_2} = Pm - H_A \cdot a$ En BC $M_x = Pm - H_A(h + y)$

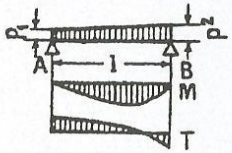
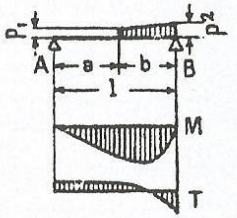
VIGAS SIMPLEMENTE APOYADAS

Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A = R_B = P;$ para $x < a$: $T = P;$ $a < x < a+b$: $T = 0;$	para $x < a$: $M_x = Px;$ $a < x < a+b$: $M_x = M_{max} = Pa;$	para $x < a$; $\theta_x = \frac{P}{2EI}(la - a^2 - x^2);$ $\theta_A = \frac{Pa}{2EI}(l-a);$ $\theta_P = \frac{Pab}{2EI};$ para $a < x < a+b$; $\theta_x = \frac{Pa}{2EI}(l-2x);$ $\theta_A = -\frac{Pa}{2EI}(l-a);$	para $x < a$: $f_x = \frac{Px}{6EI}(3la - 3a^2 - x^2);$ $f_P = \frac{Pa^2}{6EI}(3l-4a);$ $a < x < a+b;$ $f_x = \frac{Pa}{6EI}(3lx - 3x^2 - a^2);$ $f_{max} = \frac{Pa}{24EI}(3l^2 - 4a^2);$
	$R_A = R_B = \frac{pl}{2};$ $T_x = \frac{pl}{2}\left(1 - \frac{2x}{l}\right);$	$M_x = \frac{px}{2}(l-x);$ $M_{max} = \frac{pl^2}{8};$	$\theta_x = \frac{p}{24EI}(l^3 - 6lx^2 + 4x^3);$ $\theta_A = \theta_B = \frac{pl^3}{24EI};$	$f_x = \frac{px}{24EI}(l^3 - 2lx^2 + x^3);$ $f_{max} = \frac{5pl^4}{384EI};$

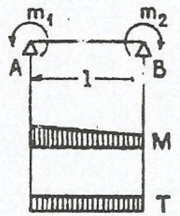
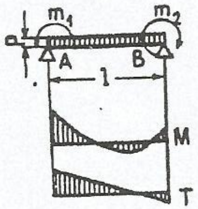
VIGAS SIMPLEMENTE APOYADAS

Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A = \frac{pcb}{l}$; $R_B = \frac{pca}{l}$; $x < a - \frac{c}{2}$: $T_x = R_A$; $a - \frac{c}{2} < x < a + \frac{c}{2}$: $T_x = R_A - p\left(x - a + \frac{c}{2}\right)$;	$x < a - \frac{c}{2}$: $M_x = R_A x$; $a - \frac{c}{2} < x < a + \frac{c}{2}$: $M_x = R_A x - \frac{p}{2}\left(x - a + \frac{c}{2}\right)^2$; $M_{max} = \frac{pabc}{l}\left(1 - \frac{c}{2l}\right)$	$\theta_A = \frac{pbc}{6EIl}\left(l^2 - b^2 - \frac{c^2}{4}\right)$, $\theta_B = -\frac{pac}{6EIl}\left(l^2 - a^2 - \frac{c^2}{4}\right)$;	$f_{max} = \frac{pc}{6EI}\left[\frac{ab}{l}\left(2al - 2a^2 - \frac{c^2}{4}\right) + \frac{c^3}{64}\right]$; $x = a$;
	$R_A = \frac{pb^2}{2l}$; $R_B = \frac{pb}{2l}(l + a)$; $x < a$: $T_x = \frac{pb^2}{2l}$; $x > a$: $T_x = \frac{pb^2}{2l} - p(x - a)$;	$x < a$: $M_x = \frac{pb^2}{2l}x = R_A x$; $x > a$: $M_x = -R_A\left[x - l\left(\frac{x-a}{b}\right)^2\right]$; $M_{max} = \frac{pl^2}{8}\left(1 - \frac{a^2}{l^2}\right)^2$; $x = \frac{b^2}{2l} + a$	$x < a$: $\theta_x = \frac{pb^2}{12EIl}\left[l^2 - \frac{b^2}{2} - 3x^2\right]$; $\theta_A = \frac{pb^2}{12EIl}\left(l^2 - \frac{b^2}{2}\right)$; $x > a$. $\theta_x = \frac{p}{12EIl}\left[l^2 b^2 - \frac{b^4}{2} + 2l(x-a)^3 - 3b^2x^2\right]$; $\theta_B = -\frac{pb^2}{12EIl}\left[2l^2 + \frac{b^2}{2} - 2lb\right]$;	$x < a$: $f_x = \frac{pb^2x}{24EIl}(2l^2 - b^2 - 2x^2)$; $f_a = \frac{pb^3a}{24EI}\frac{l+3a}{l}$; $x > a$: $f_x = \frac{p}{24EIl}[b^2(2l^2 - b^2)x + l(x-a)^4 - 2b^2x^3]$; $a > 0{,}547l$

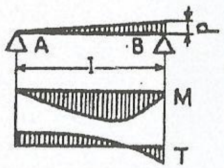
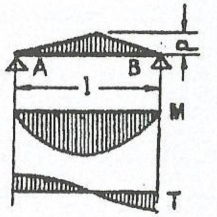
VIGAS SIMPLEMENTE APOYADAS

Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A=(2p_1+p_2)\frac{l}{6}$; $R_B=(p_1+2p_2)\frac{l}{6}$; $T_x=R_A-p_1x-$ $-(p_2-p_1)\frac{x^2}{2l}$;	$M_x=R_Ax-$ $-p_1\frac{x^2}{2}-(p_2-p_1)\frac{x^3}{6l}$; M_{max} $x=\frac{l}{p_2-p_1}\left[-p_1+\right.$ $\left.+\sqrt{\frac{1}{3}(p_1^2+p_1p_2+p_2^2)}\right]$;	$\theta_x=\frac{p_1}{24EI}(l^3-6lx^2+4x^3)+$ $+\frac{p_2-p_1}{360EIl}(7l^4-30l^2x^2+15x^4)$; $\theta_A=\frac{l^3}{EI}\left[\frac{p_1}{24}+\frac{7(p_2-p_1)}{360}\right]$; $\theta_B=-\frac{l^3}{EI}\left(\frac{p_1}{24}+\frac{p_2-p_1}{45}\right)$;	$f_x=\frac{p_1x}{24EI}(l^3-2lx^2+x^3)+\ldots.$ $+\frac{p_2-p_1}{360EI}\frac{x}{l}(7l^4-10l^2x^2+3x^4)$;
	$R_A=\frac{b^2}{6l}(2p_1+p_2)$; $R_B=\frac{(p_1+p_2)b}{2}-R_A$; $x<a$: $T_x=R_A$ $x>a$: $T_x=R_A-p_1(x-a)-$ $-\frac{(p_2-p_1)(x-a)^2}{2b}$;	$x<a$: $M_x=R_Ax$; $x>a$: $M_x=R_Ax-p_1\frac{(x-a)^2}{2}-$ $-\frac{(p_2-p_1)}{6b}(x-a)^3$; M_{max} $x=a+\frac{b}{p_2-p_1}\left[-p_1+\right.$ $\left.+\sqrt{p_1^2+\frac{b}{3l}(-2p_1^2+p_1p_2+p_2^2)}\right]$;	—	—

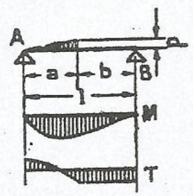
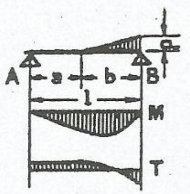
VIGAS SIMPLEMENTE APOYADAS

Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A = \frac{m_1 - m_2}{l}$; $R_B = \frac{m_2 - m_1}{l}$; $T_x = R_A$;	$M_x = m_1 - \frac{m_1 - m_2}{l} x$; $m_1 > m_2$: $M_{max} = m_1$;	$\theta_x = \frac{m_2 - m_1}{6EIl}(3x^2 - l^2) + \frac{m_1}{2EI}(2x - l)$; $\theta_A = -\frac{2m_1 + m_2}{6EI} l$; $\theta_B = \frac{m_1 - 2m_2}{6EI} l$; $m_1 = m_2 = m$: $\theta_x = \frac{m}{2EI}(2x - l)$; $\theta_A = -\theta_B = -\frac{ml}{2EI}$;	$f_x = \frac{x(x-l)}{2EI}\left[m_1 - \frac{m_2 - m_1}{3l}(x + l)\right]$; $m_1 = m_2 = m$: $f_x = \frac{mx(x-l)}{2EI}$; $f_{max} = -\frac{ml^2}{8EI}$;
	$R_A = \frac{pl}{2} - \frac{m_2 - m_1}{l}$; $R_B = \frac{pl}{2} + \frac{m_2 - m_1}{l}$; $T_x = R_A - px$;	$M_x = R_A x - m_1 - \frac{px^2}{2}$;	$\theta_x = \frac{m_2 - m_1}{6EIl}(3x^2 - l^2) + \frac{m_1}{2EI}(2x - l) + \frac{p}{24EI}(l^3 - 6lx^2 + 4x^3)$; $\theta_A = -\frac{l}{2EI}\left(m_1 + R_A \frac{l}{3} + \frac{pl^2}{12}\right)$;	$f_x = \frac{x(x-l)}{2EI}\left[m_1 + \frac{R_A}{3}(x + l) + \frac{p}{12}(x^2 + xl + l^2)\right]$; $x = \frac{l}{2}$: $f = -\frac{l^2}{8EI}\left(m_1 + \frac{R_A l}{2} + \frac{7l^2 p}{48}\right)$; $m_1 = m_2 = m$: $f_{max} = -\frac{l^2}{8EI}\left(m - \frac{5pl^2}{48}\right)$;

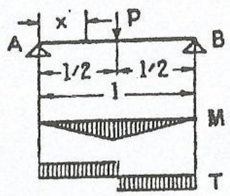
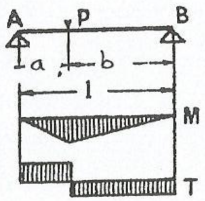
VIGAS SIMPLEMENTE APOYADAS

Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A = \frac{pl}{6}$; $R_B = \frac{pl}{3}$; $T_x = \frac{p}{2l}\left(\frac{l^2}{3} - x^2\right)$;	$M_x = \frac{px}{6l}(l^2 - x^2)$; $M_{max} = 0{,}064pl^2$; $x = 0{,}5774l$	$\theta_x = \frac{p}{360EIl}(7l^4 - 30l^2x^2 + 15x^4)$; $\theta_A = \frac{7}{360}\frac{pl^3}{EI}$; $\theta_B = -\frac{pl^3}{45EI}$;	$f_x = \frac{px}{360EIl}(7l^4 - 10l^2x^2 + 3x^4)$; $f_{max} = 0{,}00652\frac{pl^4}{EI}$; $x = 0{,}51913l$
	$x < \frac{l}{2}$: $R_A = R_B = \frac{pl}{4}$; $T_x = \frac{pl}{4}\left(1 - 4\frac{x^2}{l^2}\right)$;	$x < \frac{l}{2}$: $M_x = \frac{plx}{4}\left(1 - \frac{4}{3}\frac{x^2}{l^2}\right)$; $M_{max} = \frac{pl^2}{12}$;	$x < \frac{l}{2}$: $\theta_x = \frac{p}{24EIl}\left(\frac{5}{8}l^4 - 3l^2x^2 + 2x^4\right)$; $\theta_A = -\theta_B = \frac{5pl^3}{192EI}$;	$x < \frac{l}{2}$: $f_x = \frac{px}{24EIl}\left(\frac{5}{8}l^4 - l^2x^2 + \frac{2}{5}x^4\right)$; $f_{max} = \frac{pl^4}{120EI}$;

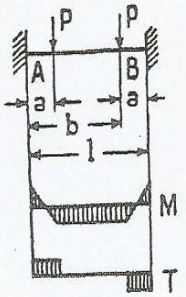
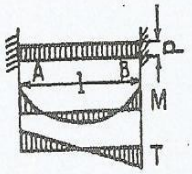
VIGAS SIMPLEMENTE APOYADAS

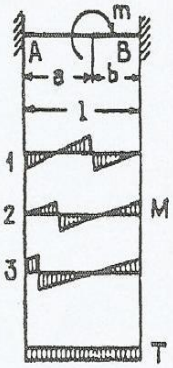
Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$x < a$: $R_A = \frac{pa}{2}\left(1-\frac{2}{3}\frac{a}{l}\right)$; $T_x = \frac{pa}{2}\left(1-\frac{2}{3}\frac{a}{l}\right)-\frac{px^2}{2a}$; $x > a$: $R_B = \frac{pa^2}{3l}$; $T_x = -\frac{pa^2}{3l}$;	$x < a$: $M_x = \frac{px}{2}\left[a\left(1-\frac{2}{3}\frac{a}{l}\right)-\frac{x^2}{3a}\right]$; $x > a$: $M_x = \frac{pa^2}{3}\left(1-\frac{x}{l}\right)$; $M_{max} = \frac{pa^2}{9}\sqrt{1-\frac{2}{3}\frac{a}{l}}(1+2b)$; $x = a\sqrt{1-\frac{2}{3}\frac{a}{l}}$	$x < a$: $\theta_x = \frac{pa^3}{360EI}\left[15\frac{x^4}{a^4}-90\frac{x^2}{a^2}+60\frac{x^3}{al}+40\frac{l}{a}-45+12\frac{a}{l}\right]$; $x > a$: $\theta_x = \frac{pa^3}{360EI}\left[60\frac{x^2}{al}-120\frac{x}{a}+40\frac{l}{a}+12\frac{a}{l}\right]$;	$x < a$: $f_x = \frac{pa^3x}{360EI}\left[3\frac{x^4}{a^4}-30\frac{x^2}{a^2}+20\frac{x^3}{al}+40\frac{l}{a}-45+12\frac{a}{l}\right]$; $x > a$: $f_x = \frac{pa^4}{360EI}\left[20\frac{x^3}{a^2l}-60\frac{x^2}{a^2}+\frac{x}{a}\left(40\frac{l}{a}+12\frac{a}{l}\right)-12\right]$;
	$x < a$: $R_A = \frac{pb^2}{6l}$; $T_x = R_A$; $x > a$: $R_B = \frac{pb}{2}\left(1-\frac{b}{3l}\right)$; $T_x = R_A-\frac{p}{2b}(x-a)^2$	$x < a$: $M_x = R_A x$; $x > a$: $M_x = R_A x-\frac{p}{6b}(x-a)^3$; $M_{max} = \frac{pb^2}{6l}x-p\frac{(x-a)^3}{6b}$; $x = a+b\sqrt{\frac{b}{3l}}$	$x < a$: $\theta_x = \frac{pb^3}{360EIl}(10l^2-3b^2-30x^2)$; $x > a$: $\theta_x = \frac{pb^3}{360EI}\left[15\left(\frac{x-a}{b}\right)^4-30\frac{x^2}{bl}+10\frac{l}{b}-3\frac{b}{l}\right]$;	$x < a$: $f_x = \frac{pb^2x}{360EIl}(10l^2-3b^2-10x^2)$; $x > a$: $f_x = \frac{pb^4}{360EI}\left[3\left(\frac{x-a}{b}\right)^5-10\frac{x^3}{b^2l}+10\frac{lx}{b^2}-3\frac{x}{l}\right]$;

VIGAS SIMPLEMENTE APOYADAS

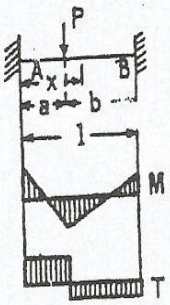
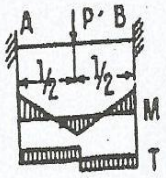
Esquema	Esf.cortante	Momentos	Ángulos de giro	Flechas
	$R_A = R_B = \frac{P}{2}$; $T_x = \pm \frac{P}{2}$;	$x \leqslant \frac{l}{2}: M_x = \frac{Px}{2}$; $x \geqslant \frac{l}{2}$: $M_x = \frac{P(l-x)}{2}$;	$x < \frac{l}{2}$: $\theta_x = \frac{P}{16EI}(l^2-4x^2)$; $\theta_A = \frac{Pl^2}{16EI}$;	$x < \frac{l}{2}$: $f_x = \frac{Px}{48EI}(3l^2-4x^2)$; $f_{máx} = \frac{Pl^3}{48EI}$;
	$R_A = \frac{Pb}{l}; R_B = \frac{Pa}{l}$; $x \leqslant a$: $T_x = \frac{Pb}{l}$; $x \geqslant a$: $T_x = -\frac{Pa}{l}$;	$x \leqslant a$: $M_x = \frac{Pb}{l}x$; $x \geqslant a$: $M_x = \frac{Pa}{l}(l-x)$; $M_{max} = \frac{Pab}{l}$;	$x < a$: $\theta_x = \frac{Pb}{6EIl}(l^2-b^2-3x^2)$; $\theta_A = \frac{Pb}{6EIl}(l^2-b^2)$; $x > a$: $\theta_x = \frac{Pa}{6EIl}(2l^2-6lx+3x^2+a^2)$; $\theta_B = \frac{Pa}{6EIl}(a^2-l^2)$; $\theta_p = \frac{Pab}{3EIl}(b-a)$;	$x < a$: $f_x = \frac{Pbx}{6EIl}(l^2-b^2-x^2)$; $x > a$: $f_x = \frac{Pa(l-x)}{6EIl}(2lx-a^2-x^2)$; $a > b$: $f_P = \frac{Pa^2b^2}{3EIl}$; $f_{max} = \frac{Pb}{3EIl}\sqrt{\left(\frac{a^2+2ab}{3}\right)^3}$; $x = \sqrt{\frac{a}{3}(a+2b)}$;

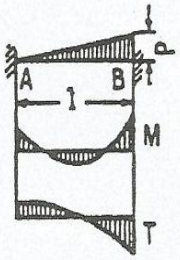
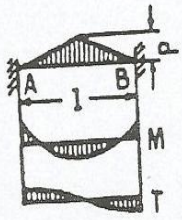
VIGAS EMPOTRADAS EN LOS DOS APOYOS

Esquema	Momentos
	$x < a$: $M_x = P\left(x - \frac{ab}{l}\right)$; $M_A = -P\frac{ab}{l}$; $a < x < b$: $M_x = P\frac{a^2}{l}$ $b < x < l$: $M_x = P\left(\frac{a^2}{l} + b - x\right)$; $M_B = -P\frac{ab}{l}$.
	$M_x = -\frac{pl^2}{12}\left(1 - 6\frac{x}{l} + 6\frac{x^2}{l^2}\right)$; $M_A = M_B = -\frac{pl^2}{12}$; $M_{max} = \frac{pl^2}{24}$

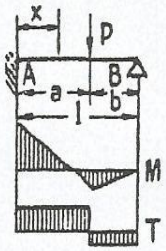
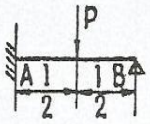
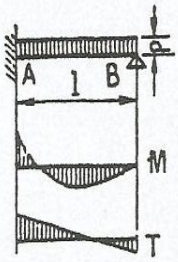
Esquema	Momentos
	$x < a$: $M_x = \frac{mb}{l^3}\left[\frac{6ax}{l} - (2a - b)\right]$; $M_A = \frac{mb}{l^2}(b - 2a)$; $x = a$: $M_{a1} = \frac{mb}{l^3}(4a^2 + b^2 - ab)$; $M_{a2} = -\frac{ma}{l^3}(a^2 + 4b^2 - ab)$; $x > a$: $M_x = \frac{ma}{l^2}\left[(a + 4b) - \frac{6bx}{l}\right]$; $M_B = \frac{ma}{l^2}(a - 2b)$.

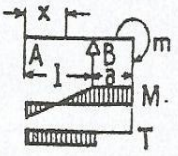
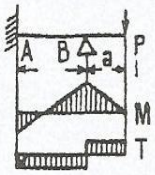
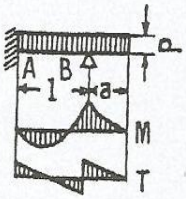
VIGAS EMPOTRADAS EN LOS DOS APOYOS

Esquema	Momentos
	$x < a$: $M_x = P\frac{b^2}{l}\left[\frac{(3a+b)x}{l^2} - \frac{a}{l}\right]$; $x > a$: $M_x = P\frac{b^2}{l}\left[\frac{(3a+b)x}{l^2} - \frac{a}{l}\right] - P(x-a)$; $M_A = -P\frac{ab^2}{l^2}$; $M_B = -P\frac{a^2b}{l^2}$; $x = a$: $M_a = \frac{2Pa^2b^2}{l^3}$.
	$x < \frac{l}{2}$: $M_x = \frac{Pl}{8}\left(\frac{4x}{l} - 1\right)$; $M_A = M_B = -\frac{Pl}{8}$; $M_{1/2} = \frac{Pl}{8}$

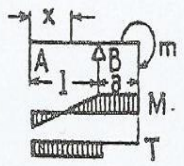
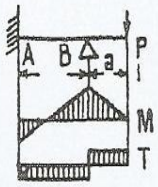
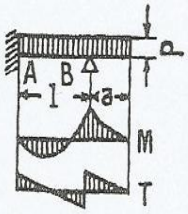
Esquema	Momentos
	$M_x = \frac{pl^2}{60}\left(9\frac{x}{l} - 10\frac{x^3}{l^3} - 2\right)$; $M_A = -\frac{pl^2}{30}$; $M_B = -\frac{pl^2}{20}$; $M_{max} = \frac{pl^2}{46,6}$; $x = 0,548l$
	$x < \frac{l}{2}$: $M_x = \frac{plx}{4}\left(1 - \frac{4x^2}{3l^2}\right) - M_A$; $M_A = -\frac{5}{96}pl^2$; $M_{max} = \frac{pl^2}{32}$; $x = \frac{l}{2}$

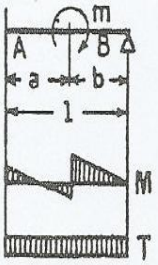
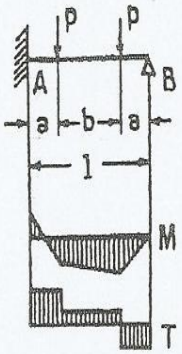
VIGAS EMPOTRADAS-APOYADAS

Esquema	Momentos
	$x < a$: $M_x = M_A + R_A x$; $M_A = -\frac{Pab}{2l}\left(1+\frac{b}{l}\right)$; $x > a$: $M_x = M_A + R_A x + P(x-a)$; $M_{max} = R_B b$; $x = a$;
	$M_A = -\frac{3}{16}Pl$; $M_{l/2} = \frac{5}{32}Pl$;
	$M_x = -\frac{pl^2}{8}\left(1-\frac{5x}{l}+\frac{4x^2}{l^2}\right)$; $M_A = -\frac{pl^2}{8}$; $M_{max} = \frac{9}{128}pl^2$; $x = 0{,}625l$ $M = 0 \qquad x = \frac{l}{4}$;

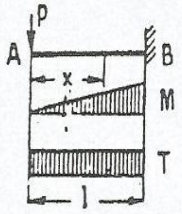
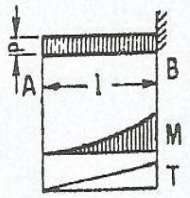
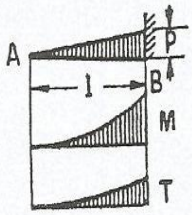
Esquema	Momentos
	$M_A = +\frac{m}{2}$; $M_B = -m$.
	$M_A = \frac{Pa}{2}$; $M_B = -Pa$.
	$M_A = -\frac{p}{8}(l^2-2a^2)$; $M_A = 0$ $a = 0{,}707l$; $M_B = -\frac{pa^2}{2}$

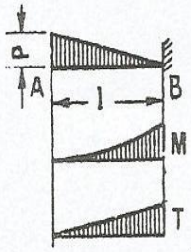
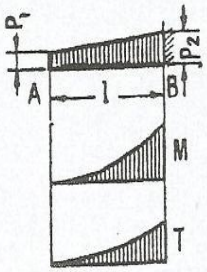
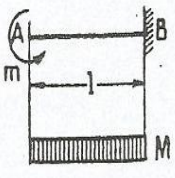
VIGAS EMPOTRADAS-APOYADAS

Esquema	Momentos
	$M_A = +\frac{m}{2}$; $M_B = -m$.
	$M_A = \frac{Pa}{2}$; $M_B = -Pa$.
	$M_A = -\frac{p}{8}(l^2 - 2a^2)$; $M_A = 0$ $a = 0{,}707l$; $M_B = -\frac{pa^2}{2}$.

Esquema	Momentos
	$x < a$: $M_x = M_A + R_A x$; $M_A = \frac{m}{2}\left(3\frac{b^2}{l^2} - 1\right)$; $x > a$: $M_x = \frac{3m}{2}\left(1 - \right.$ $\left. - \frac{b^2}{l^2}\right)\left(\frac{x}{l} - 1\right)$.
	$M_A = -\frac{3}{2}\frac{Pab}{l}$; $x = a$: $M_a = M_A + R_A a$: $x = a + b$: $M_{a+b} = R_B a$.

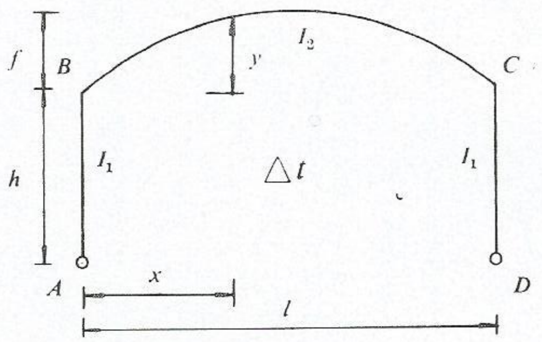
VOLADIZOS

Esquema	Momentos
	$M_x = -Px;$ $M_B = -Pl;$
	$M_x = -\frac{px^2}{2};$ $M_B = -\frac{pl^2}{2};$
	$M_x = -\frac{px^3}{6l};$ $M_B = -\frac{pl^2}{6};$

Esquema	Momentos
	$M_x = -\frac{px^2}{2}\left(1-\frac{x}{3l}\right);$ $M_B = -\frac{pl^2}{3};$
	$M_x = -p_1\frac{x^2}{2} -$ $-\frac{p_2-p_1}{6l}x^3;$ $M_B = \frac{2p_1+p_2}{6}l^2;$
	$M_x = M_B = m;$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Aumento uniforme de temperatura



E = módulo de elasticidad

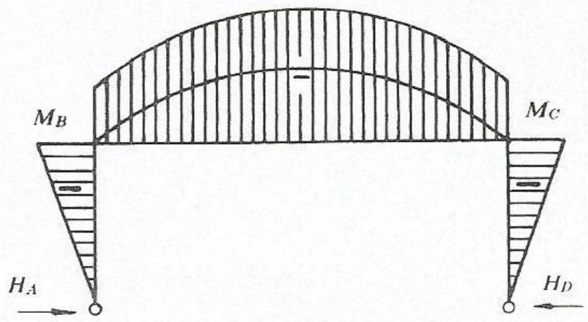
α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

Reacciones:

$$H_A = H_D = \frac{15EI_2\alpha\,\Delta t}{5h^2(2k+3)+4f(5h+2f)}$$

Momentos flectores:

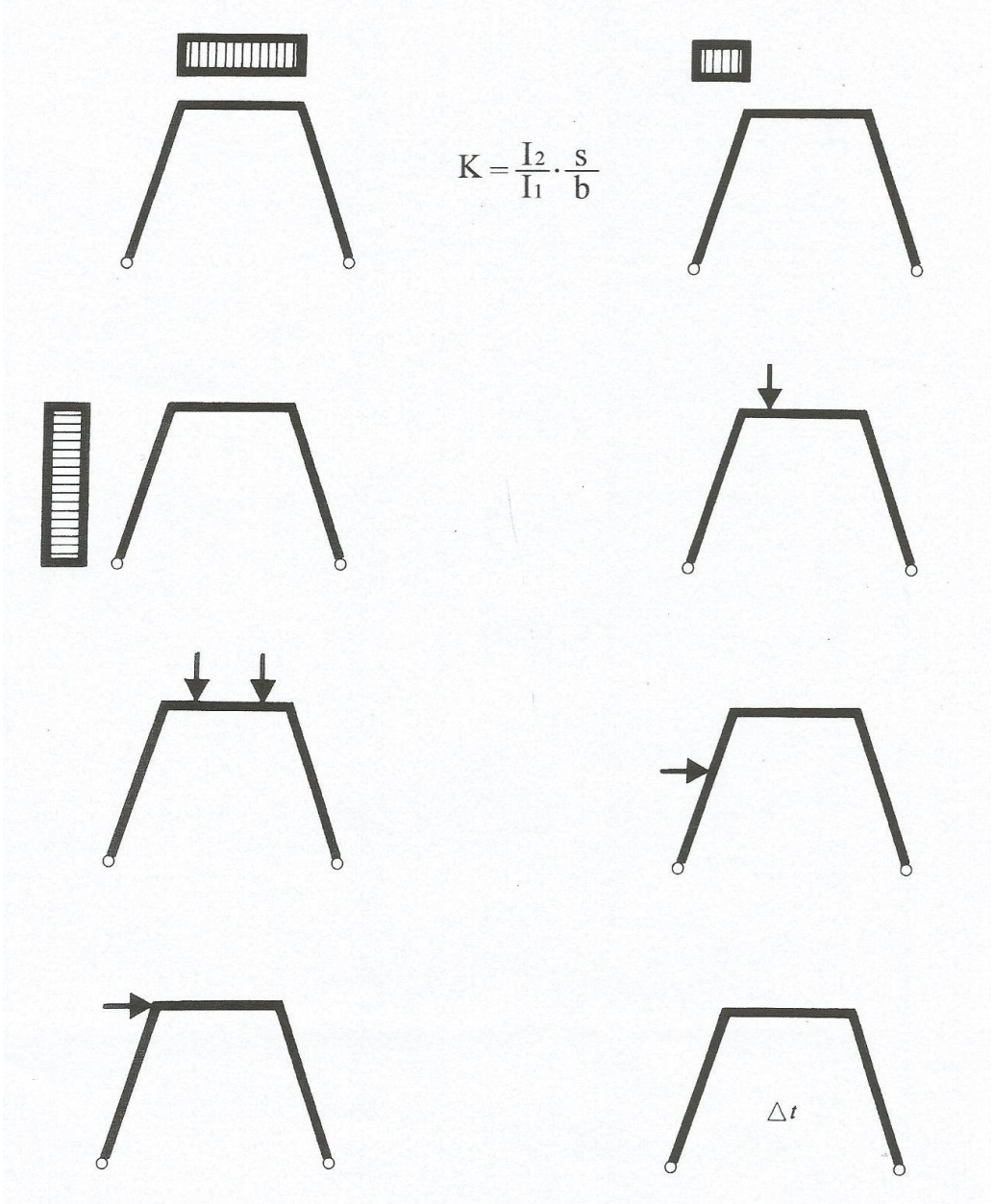


$$M_B = M_C = -\frac{15EI_2\alpha\,\Delta t\,h}{5h^2(2k+3)+4f(5h+2f)}$$

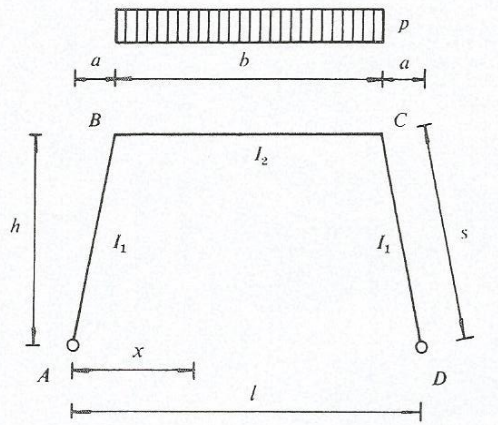
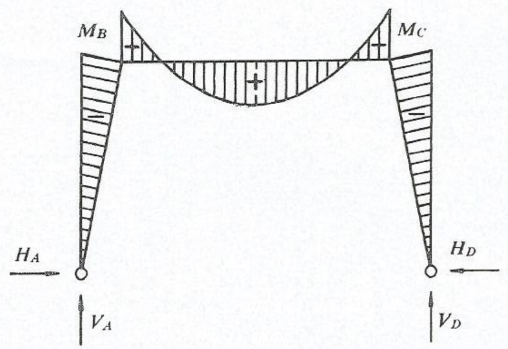
En BC

$$M_x = M_B\left(1+\frac{y}{h}\right)$$

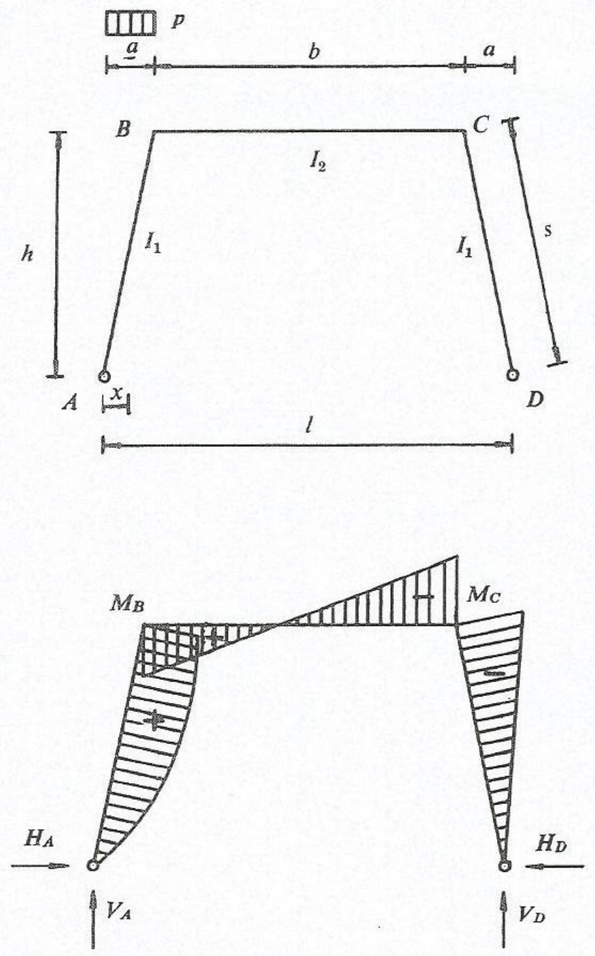
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS



PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = V_D = p\dfrac{b}{2}$ $H_A = H_D = \dfrac{pb}{4h}\,\dfrac{2a(2k+3)+b}{2k+3}$
	**Momentos flectores:** $M_B = M_C = -\dfrac{pb^2}{4(2k+3)}$ En BC $M_x = -\dfrac{pb}{4}\,\dfrac{2(a-x)(2k+3)+b}{2k+3} - \dfrac{p(x-b)^2}{2}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS



Reacciones:

$$V_A = pa\,\frac{2l - a}{2l}$$

$$V_D = \frac{pa^2}{2l}$$

$$H_A = H_D = \frac{pa^2}{8h}\,\frac{5k + 6}{2k + 3}$$

Momentos flectores:

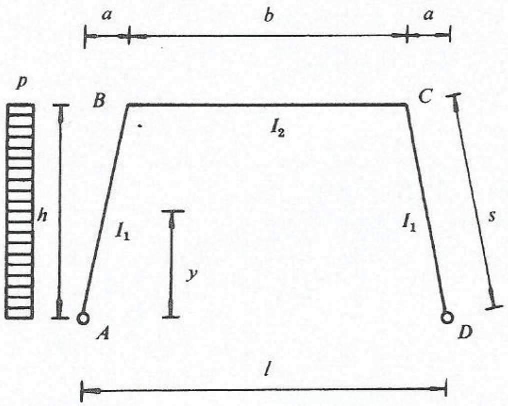
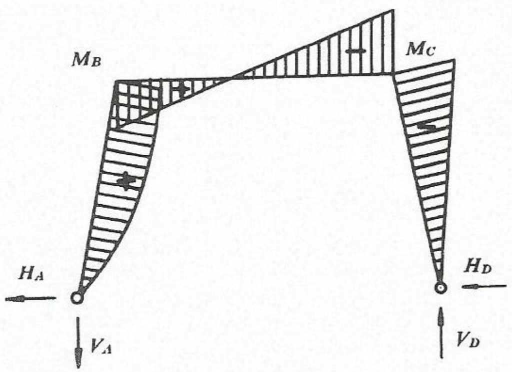
$$M_B = \frac{pa^2}{4}\left(\frac{b}{l} - \frac{k}{2(2k + 3)}\right)$$

$$M_C = -\frac{pa^2}{4}\left(\frac{b}{l} + \frac{k}{2(2k + 3)}\right)$$

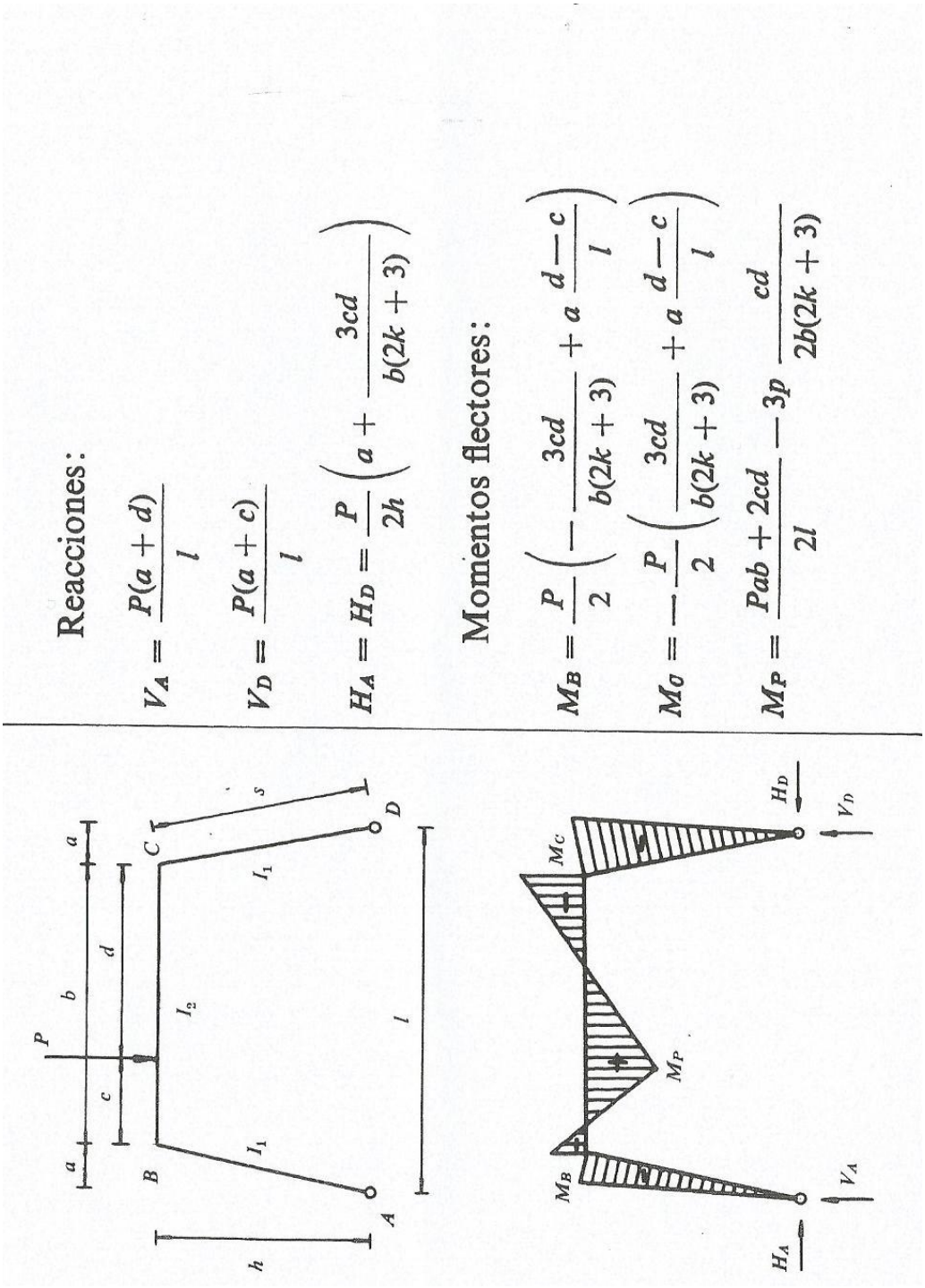
En AB

$$M_x = pa\,\frac{2l - a}{2l}\,x - \frac{pa}{8}\,\frac{5k + 6}{2k + 3}\,x - \frac{px^2}{2}$$

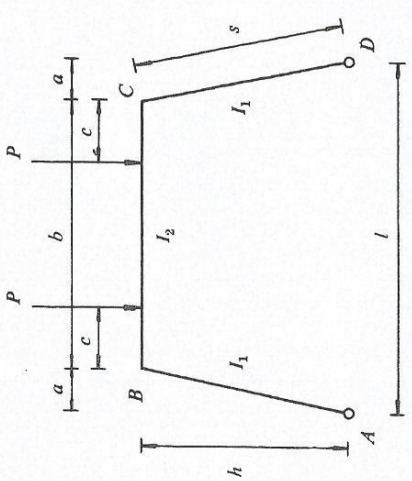
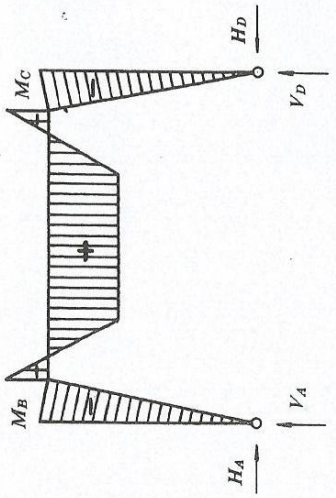
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = V_D = \frac{ph^2}{2l}$ $H_A = \frac{ph}{8} \frac{11k + 18}{2k + 3}$ $H_D = \frac{ph}{8} \frac{5k + 6}{2k + 3}$
	**Momentos flectores:** $M_B = \frac{ph^2}{8} \left(\frac{2b}{l} - \frac{k}{2k + 3} \right)$ $M_C = - \frac{ph^2}{8} \left(\frac{2b}{l} + \frac{k}{2k + 3} \right)$ En AB $My = - \frac{pha}{2l} y + \frac{ph}{8} \frac{11k + 18}{2k + 3} y - \frac{py^2}{2}$

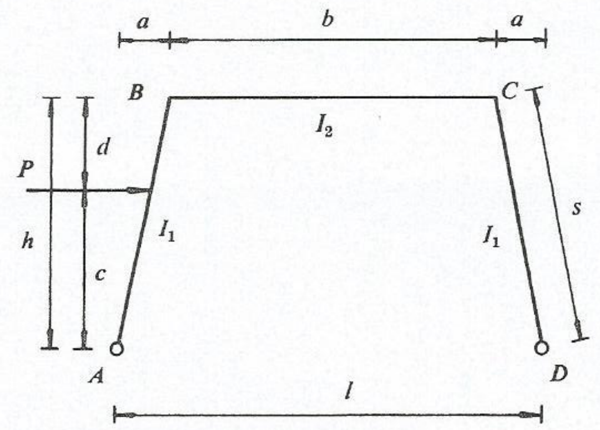
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

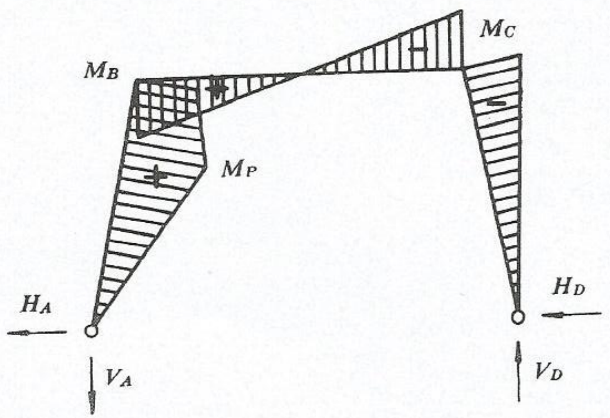


PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

Esquemas	Reacciones y solicitaciones
 	Reacciones: $V_A = V_D = P$ $H_A = H_B = \frac{P}{h}\left(a + \frac{3c(b-c)}{b(2k+3)}\right)$ Momentos flectores: $M_B = M_C = -\frac{3Pc(b-c)}{b(2k+3)}$ $M_P = P_o - \frac{3Pc(b-c)}{b(2k+3)}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS





Reacciones:

$$V_A = V_D = \frac{Pc}{l}$$

$$H_A = P\,\frac{h+d}{2h} - \frac{Pcd}{2h^3}\,\frac{h+c}{2k+3}\,k$$

$$H_D = \frac{Pc}{2h} + \frac{Pcd}{2h^3}\,\frac{h+c}{2k+3}\,k$$

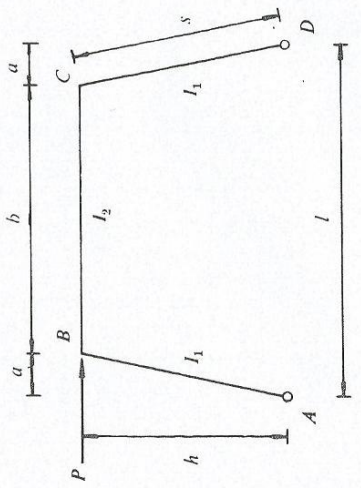
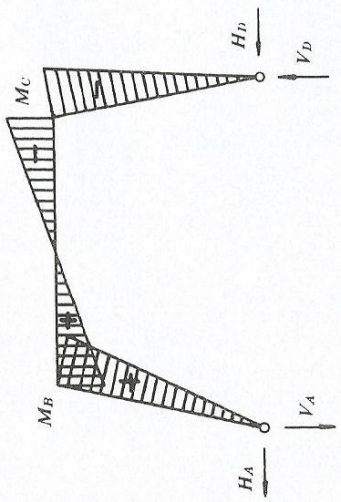
Momentos flectores:

$$M_B = \frac{Pcb}{2l} - \frac{Pcd(h+c)k}{2h^2(2k+3)}$$

$$M_C = -\frac{Pcb}{2l} - \frac{Pcd(h+c)}{2h^2(2k+3)}\,k$$

$$M_P = P\,\frac{h+d}{2h}\,c - \frac{Pc^2d}{2h^3}\,\frac{h+c}{2k+3}\,k - \frac{Pc^2}{l}\,\frac{a}{h}$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{Ph}{l}$ $H_A = H_D = \frac{P}{2}$ Momentos flectores: $M_B = -M_C = \frac{Phb}{2l}$
	

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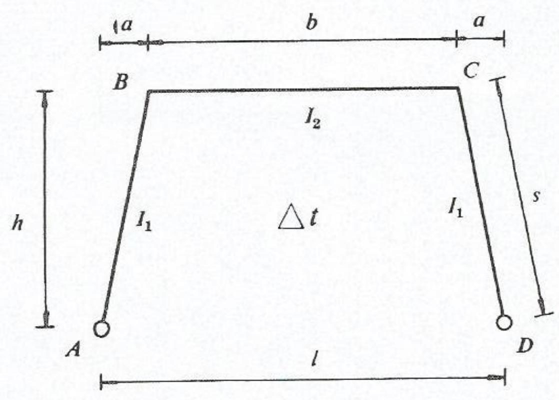
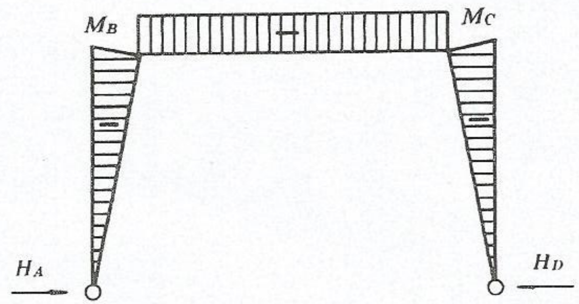
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRAPECIALES SIMÉTRICOS

Aumento uniforme de temperatura





E = módulo de elasticidad

α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

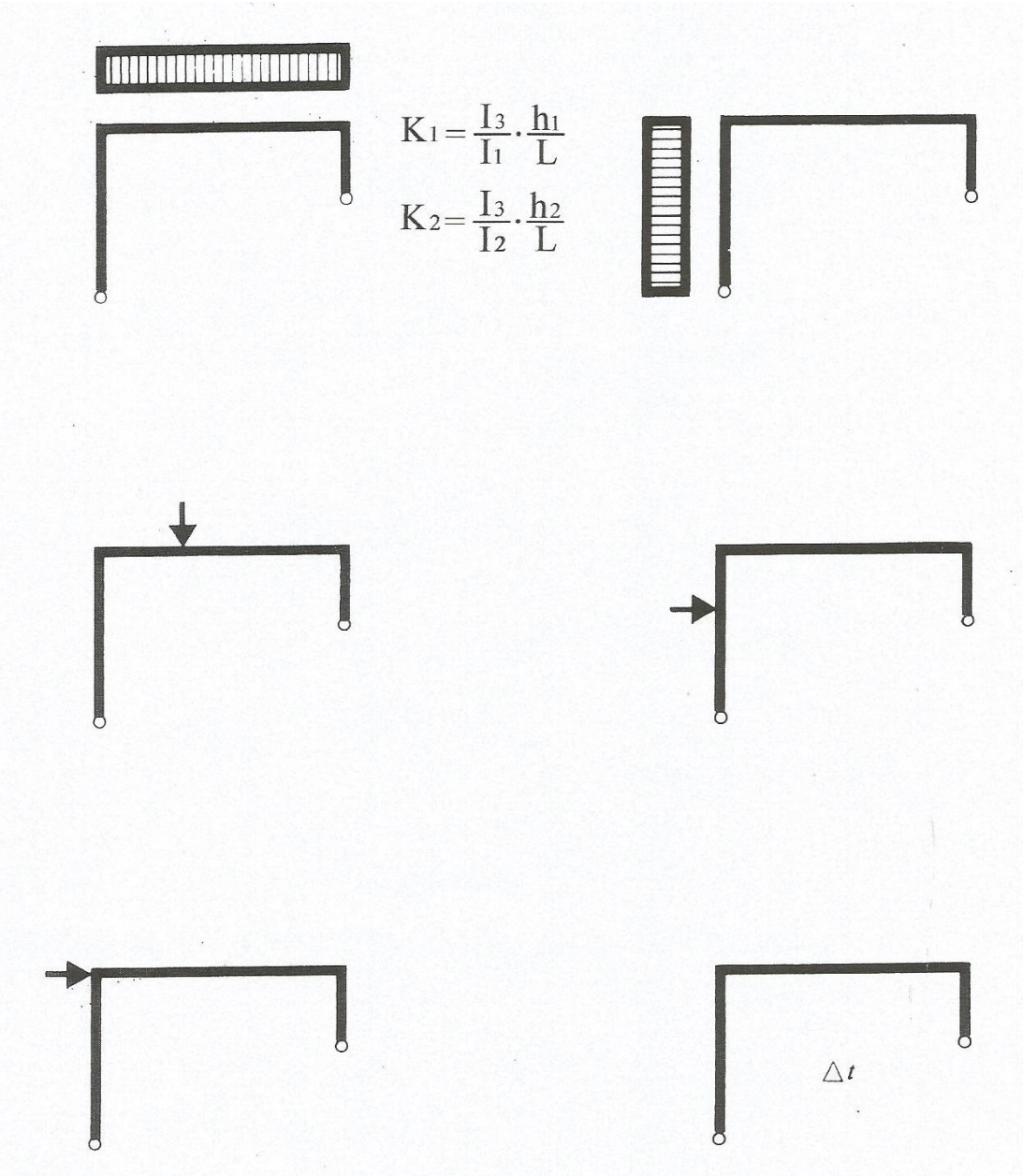
Reacciones:

$$H_A = H_D = \frac{3EI_2\alpha\,\Delta t\,l}{h^2b(2k+3)}$$

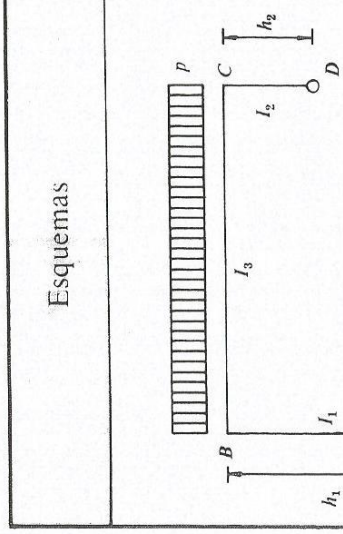
Momentos flectores:

$$M_B = M_C = -\frac{3EI_2\alpha\,\Delta t\,l}{bh(2k+3)}$$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS

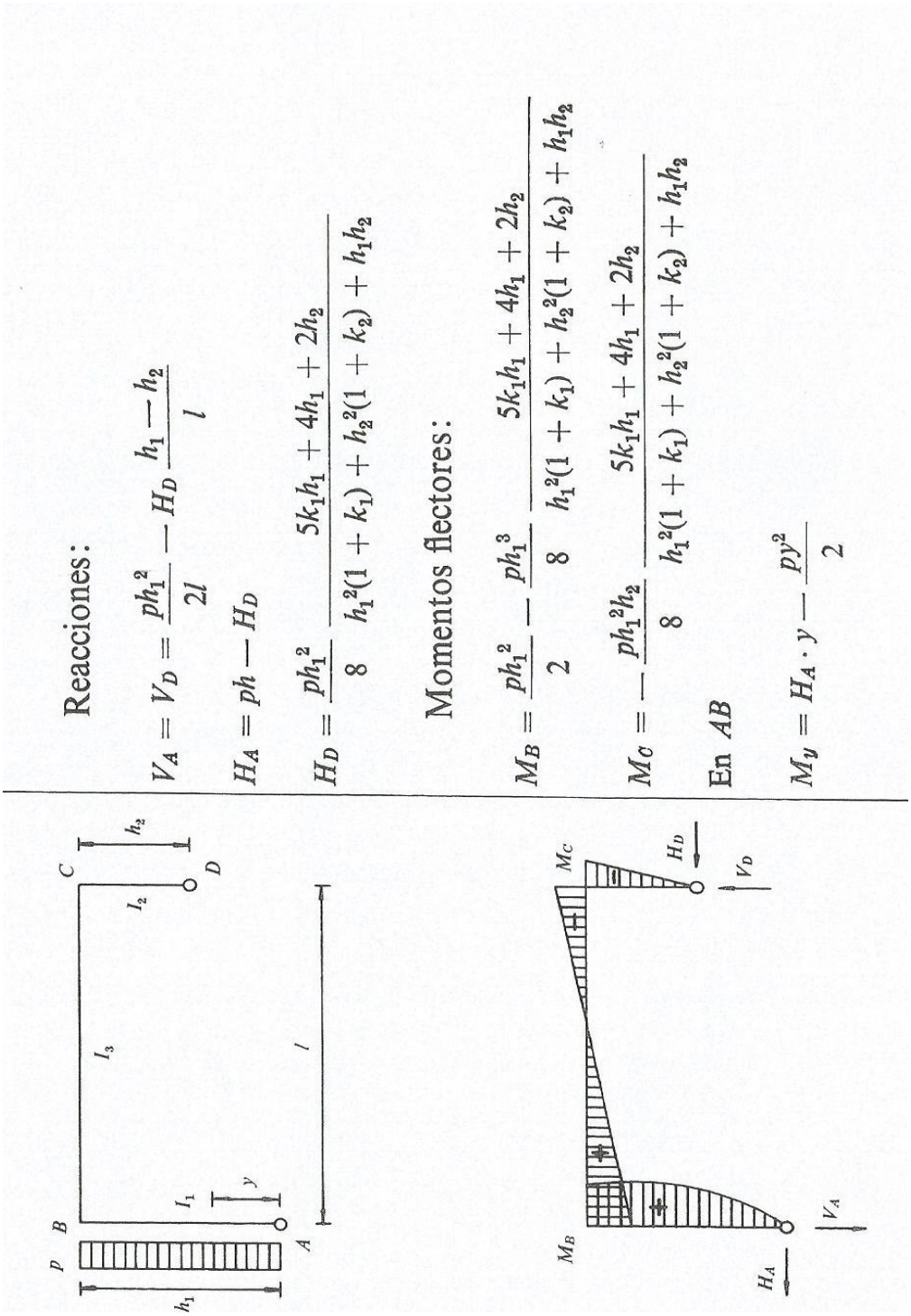


PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{pl}{2} + \frac{pl}{8}\,\frac{h_1^2 - h_2^2}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ $V_D = \frac{pl}{2} - \frac{pl}{8}\,\frac{h_1^2 - h_2^2}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ $H_A = H_D = \frac{pl^2}{8}\,\frac{h_1 + h_2}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ Momentos flectores: $M_B = -\frac{pl^2}{8}\,\frac{(h_1+h_2)h_1}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ $M_C = -\frac{pl^2}{8}\,\frac{(h_1+h_2)h_2}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ En BC $M_x = V_A \cdot x - \frac{px^2}{2} - H_A \cdot h_1$

361 (99T)

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS



Reacciones:

$$V_A = V_D = \frac{ph_1^2}{2l} - H_D\frac{h_1 - h_2}{l}$$

$$H_A = ph - H_D$$

$$H_D = \frac{ph_1^2}{8}\,\frac{5k_1h_1 + 4h_1 + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

Momentos flectores:

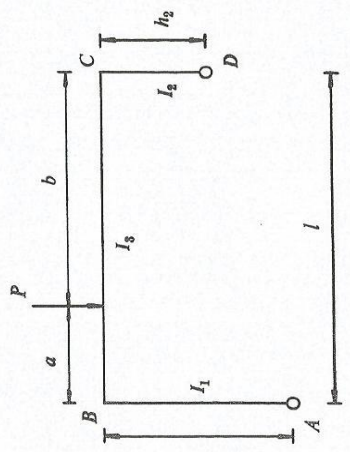
$$M_B = \frac{ph_1^2}{2} - \frac{ph_1^3}{8}\,\frac{5k_1h_1 + 4h_1 + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_C = -\frac{ph_1^2h_2}{8}\,\frac{5k_1h_1 + 4h_1 + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

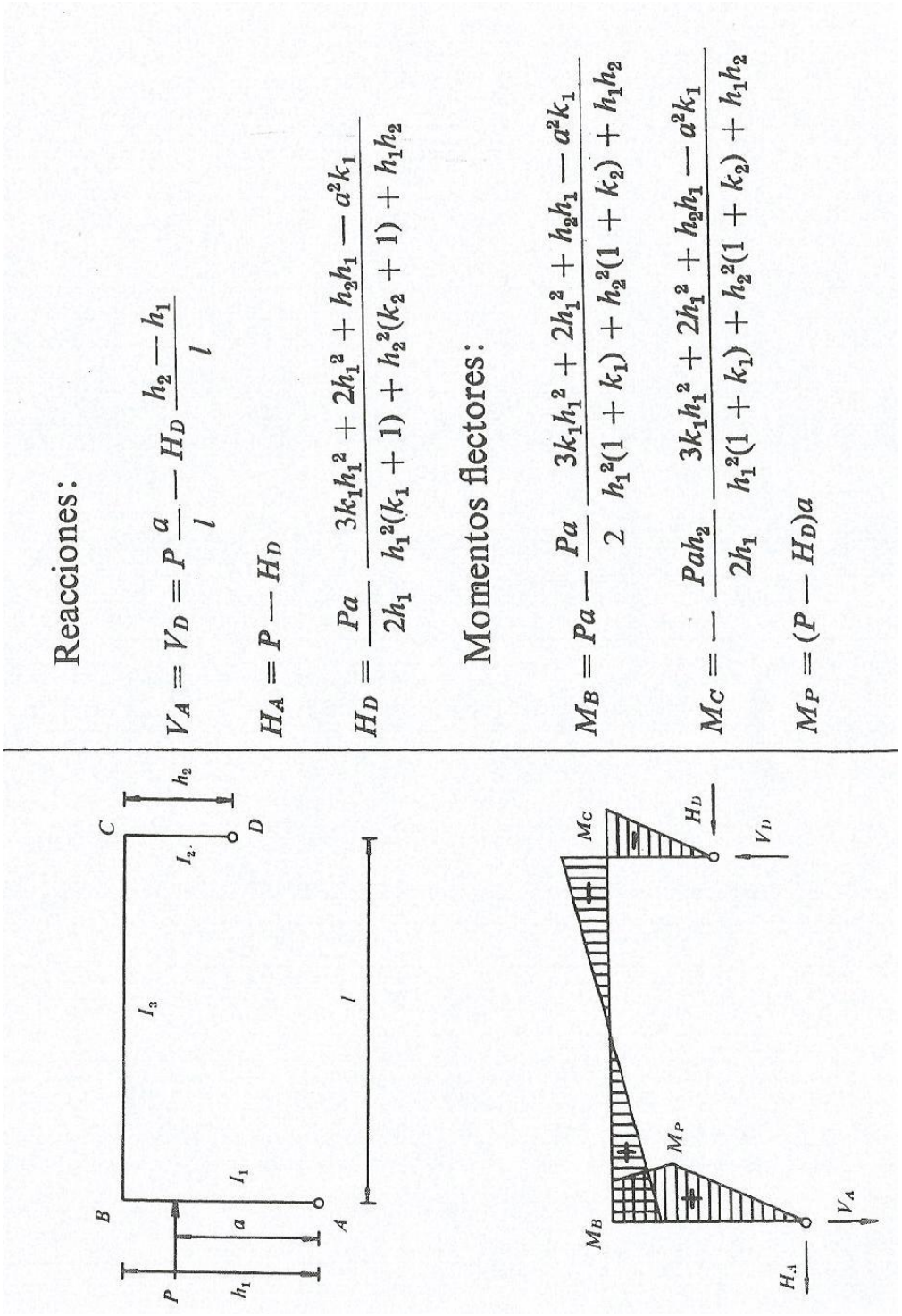
En AB

$$M_y = H_A \cdot y - \frac{py^2}{2}$$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{Pb}{l} + \frac{Pab}{2l^3}\frac{(l+b)h_1+(l+a)h_2}{h_1^2(1+k_1)+h_2^2(1+k_2)+h_1h_2}(h_1-h_2)$ $V_D = \frac{Pa}{l} - \frac{Pab}{2l^3}\frac{(l+b)h_1+(l+a)h_2}{h_1^2(1+k_1)+h_2^2(1+k_2)+h_1h_2}(h_1-h_2)$ $H_A = H_D = \frac{Pab}{2l^2}\frac{(l+b)h_1+(l+a)h_2}{h_1^2(1+k_1)+h_2^2(1+k_2)+h_1h_2}$ Momentos flectores: $M_B = -\frac{Pabh_1}{2l^2}\frac{(l+b)h_1+(l+a)h_2}{h_1^2(1+k_1)+h_2^2(1+k_2)+h_1h_2}$ $M_C = -\frac{Pabh_2}{2l^2}\frac{(l+b)h_1+(l+a)h_2}{h_1^2(1+k_1)+h_2^2(1+k_2)+h_1h_2}$ $M_P = V_A \cdot a + M_B$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS



Reacciones:

$$V_A = V_D = P\frac{a}{l} - H_D\frac{h_2 - h_1}{l}$$

$$H_A = P - H_D$$

$$H_D = \frac{Pa}{2h_1}\,\frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(k_1 + 1) + h_2^2(k_2 + 1) + h_1h_2}$$

Momentos flectores:

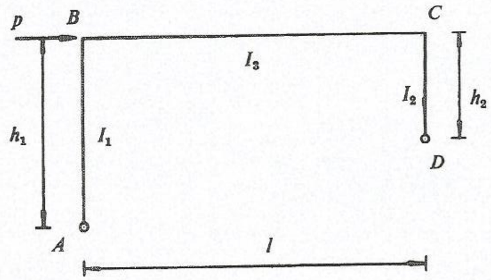
$$M_B = Pa - \frac{Pa}{2}\,\frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_C = -\frac{Pah_2}{2h_1}\,\frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_P = (P - H_D)a$$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS

Esquemas	Reacciones y solicitaciones

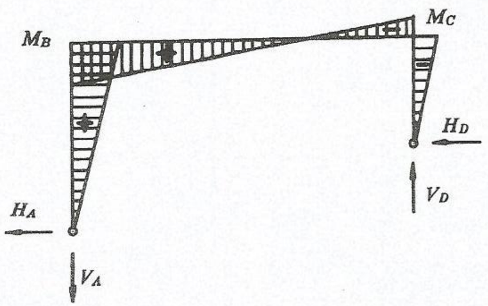


Reacciones:

$$V_A = V_D = \frac{Ph_1}{l} - H_D \frac{h_2 - h_1}{l}$$

$$H_A = P - H_D$$

$$H_D = \frac{P}{2} \frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$



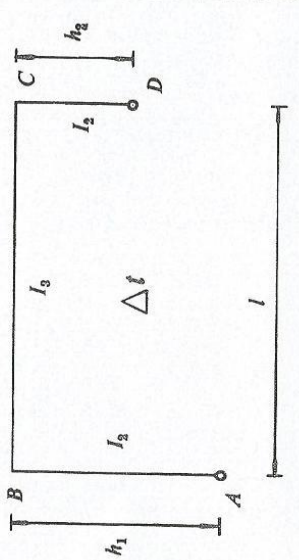
Momentos flectores:

$$M_B = Ph_1 - \frac{Ph_1}{2} \frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_C = -\frac{Ph_2}{2} \frac{3k_1h_1^2 + 2h_1^2 + h_2h_1 - a^2k_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y DOS COLUMNAS

Aumento uniforme de temperatura



E = módulo de elasticidad

α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

Reacciones:

$$V_A = V_D = \frac{3EI_3\alpha\,\Delta t\,(h_1 - h_2)}{l^3}\,\frac{l^2 + (h_1 - h_2)^2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

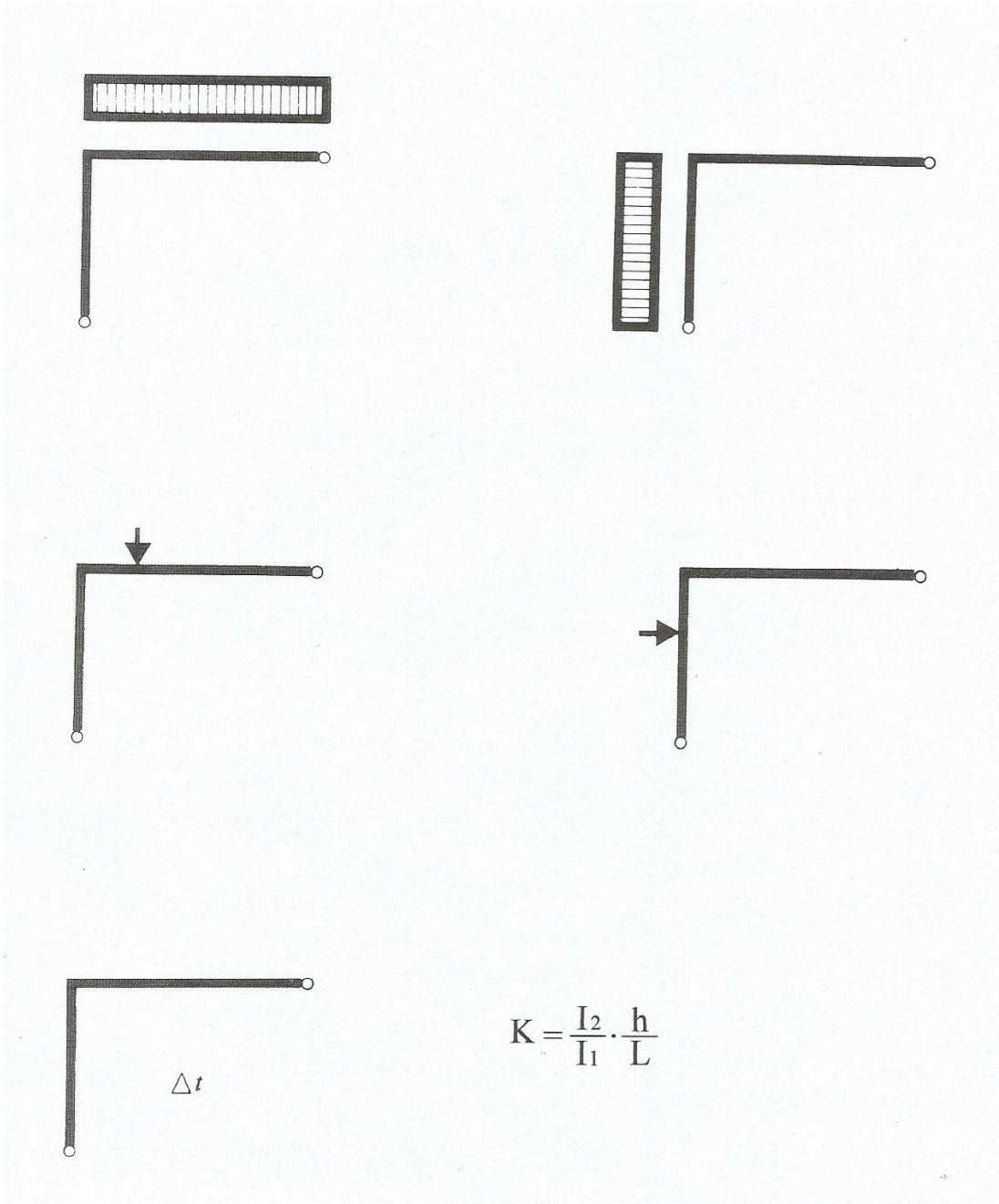
$$H_A = H_D = \frac{3EI_3\alpha\,\Delta t}{l^2}\,\frac{l^2 + (h_1 - h_2)^2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

Momentos flectores:

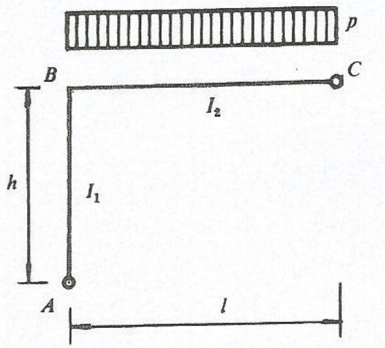
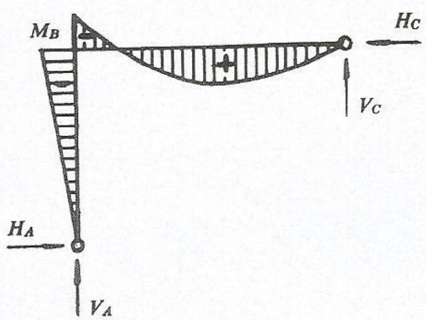
$$M_B = -\frac{3EI_3\alpha\,\Delta t\,h_1}{l^2}\,\frac{l^2 + (h_1 - h_2)^2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_C = -\frac{3EI_3\alpha\,\Delta t\,h_2}{l^2}\,\frac{l^2 + (h_1 - h_2)^2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA



PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = \frac{pl}{2} + H_A \frac{h}{l}$ $V_C = \frac{pl}{2} - H_A \frac{h}{l}$ $H_A = H_C = \frac{pl^2}{8h(k+1)}$
	**Momentos flectores:** $M_B = -\frac{pl^2}{8(k+1)}$ En BC $M_x = V_A \cdot x - H_A \cdot h - \frac{px^2}{2}$

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA

Reacciones:

$$V_A = V_C = \frac{M_B}{l}$$

$$H_A = ph - H_C$$

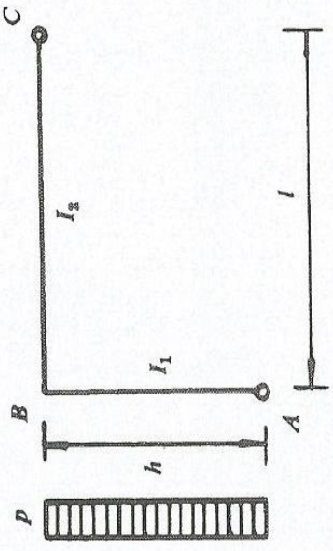
$$H_C = \frac{ph}{8(k+1)}(5k+4)$$

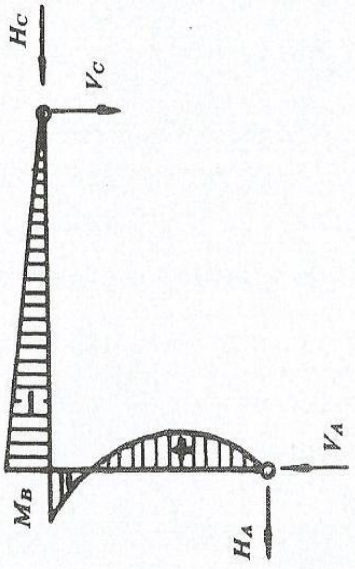
Momentos flectores:

$$M_B = -\frac{ph^2k}{8(k+1)}$$

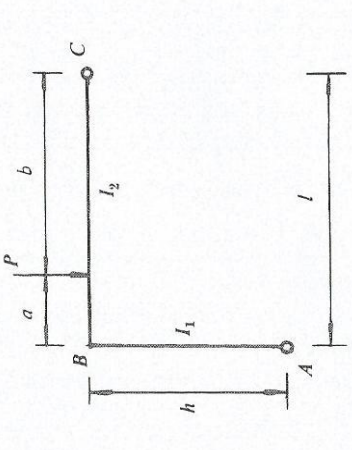
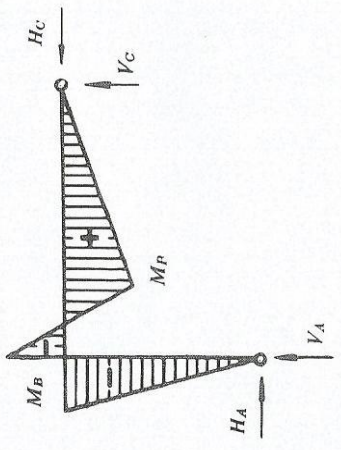
En AB

$$M_y = H_A \cdot y - \frac{py^2}{2}$$





PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{Pb - M_B}{l}$ $V_C = P - V_A$ $H_A = H_C = \frac{Pab}{2l^2h}\,\frac{l+b}{k+1}$ Momentos flectores: $M_B = -\frac{Pab}{2l^2}\,\frac{l+b}{k+1}$ $M_P = \frac{Pa + M_B}{l}\,b$
	

PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA

Reacciones:

$$V_A = V_C = \frac{M_B}{l}$$

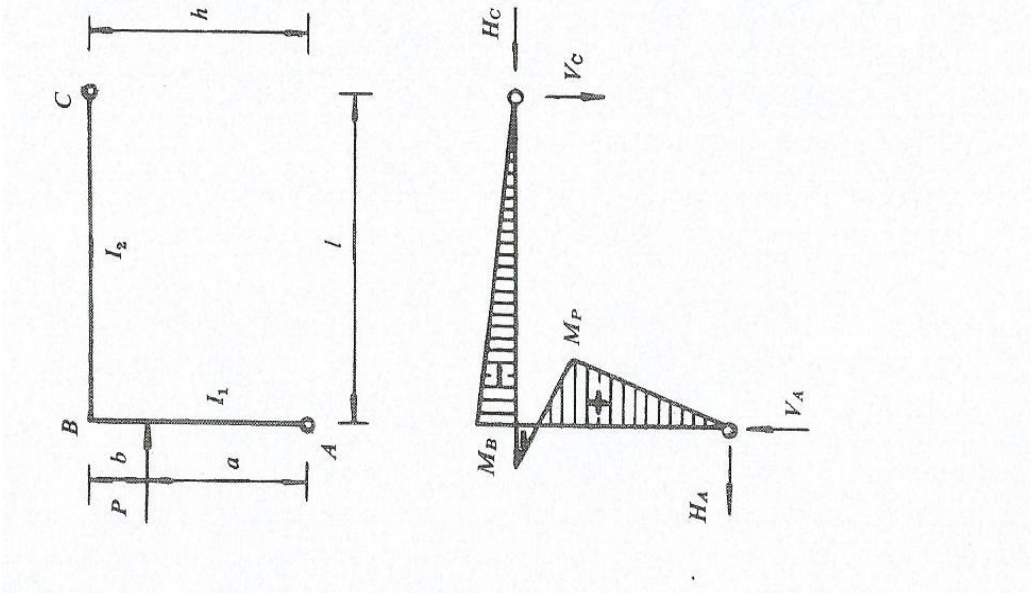
$$H_A = P - H_C$$

$$H_C = \frac{Pa}{2h^3}\,\frac{2h^2 + (3h^2 - a^2)k}{k+1}$$

Momentos flectores:

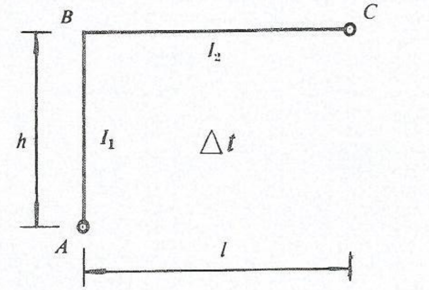
$$M_B = -\frac{Pabk}{2h^2}\,\frac{h+a}{k+1}$$

$$M_P = \frac{Pb + M_B}{l}\,b$$



PÓRTICOS SIMPLES BIARTICULADOS A DISTINTA ALTURA DINTEL HORIZONTAL Y UNA COLUMNA

Esquemas	Reacciones y solicitaciones
Aumento uniforme de temperatura	



E = módulo de elasticidad

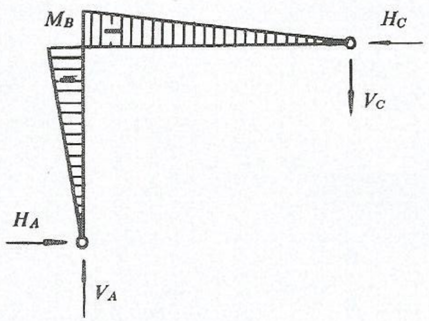
α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

Reacciones:

$$V_A = V_C = H_A \frac{h}{l}$$

$$H_A = H_C = \frac{3EI_2\alpha\,\Delta t}{h^2(k+1)} \frac{l^2 + h^2}{l^2}$$

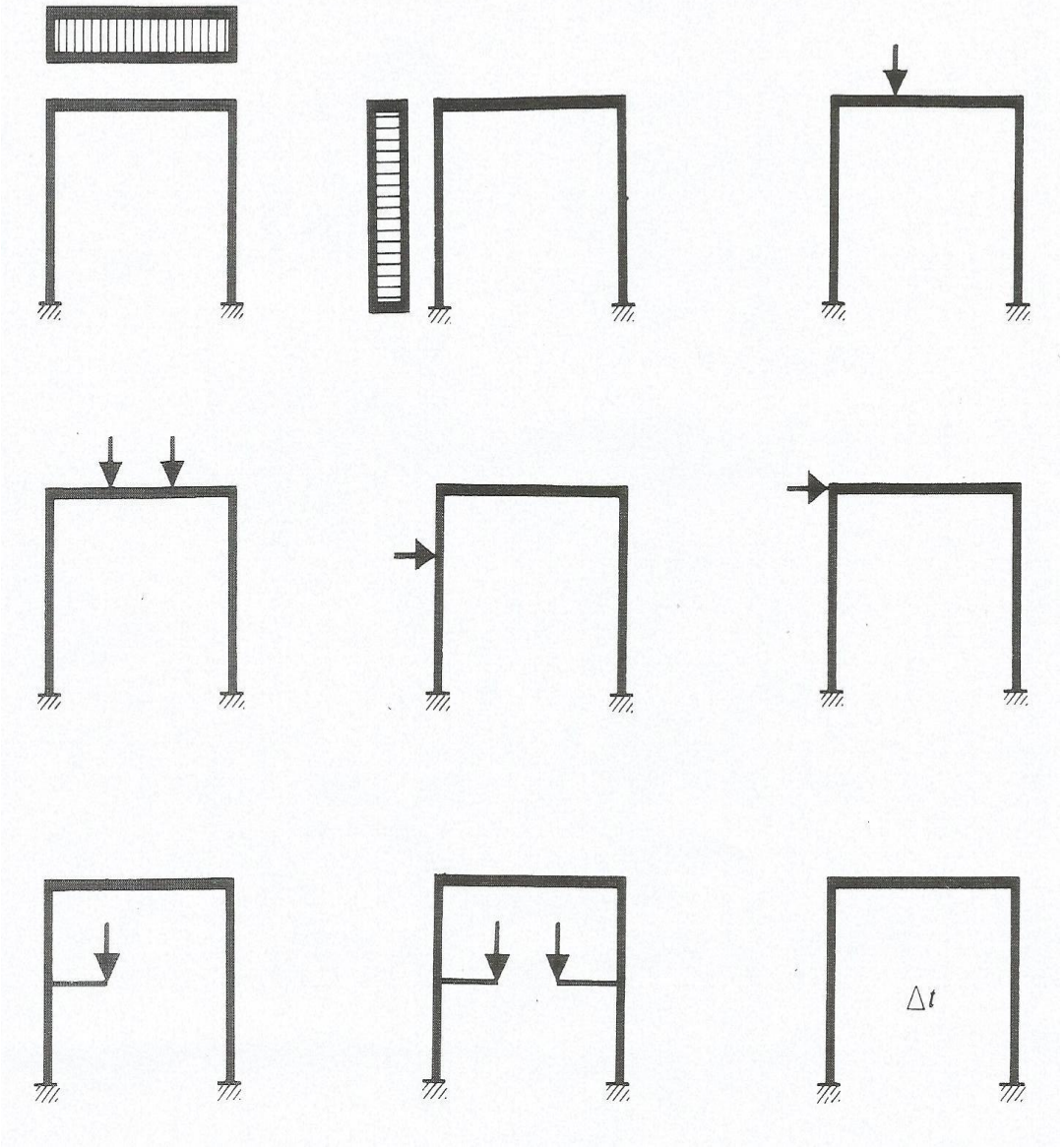


Momentos flectores:

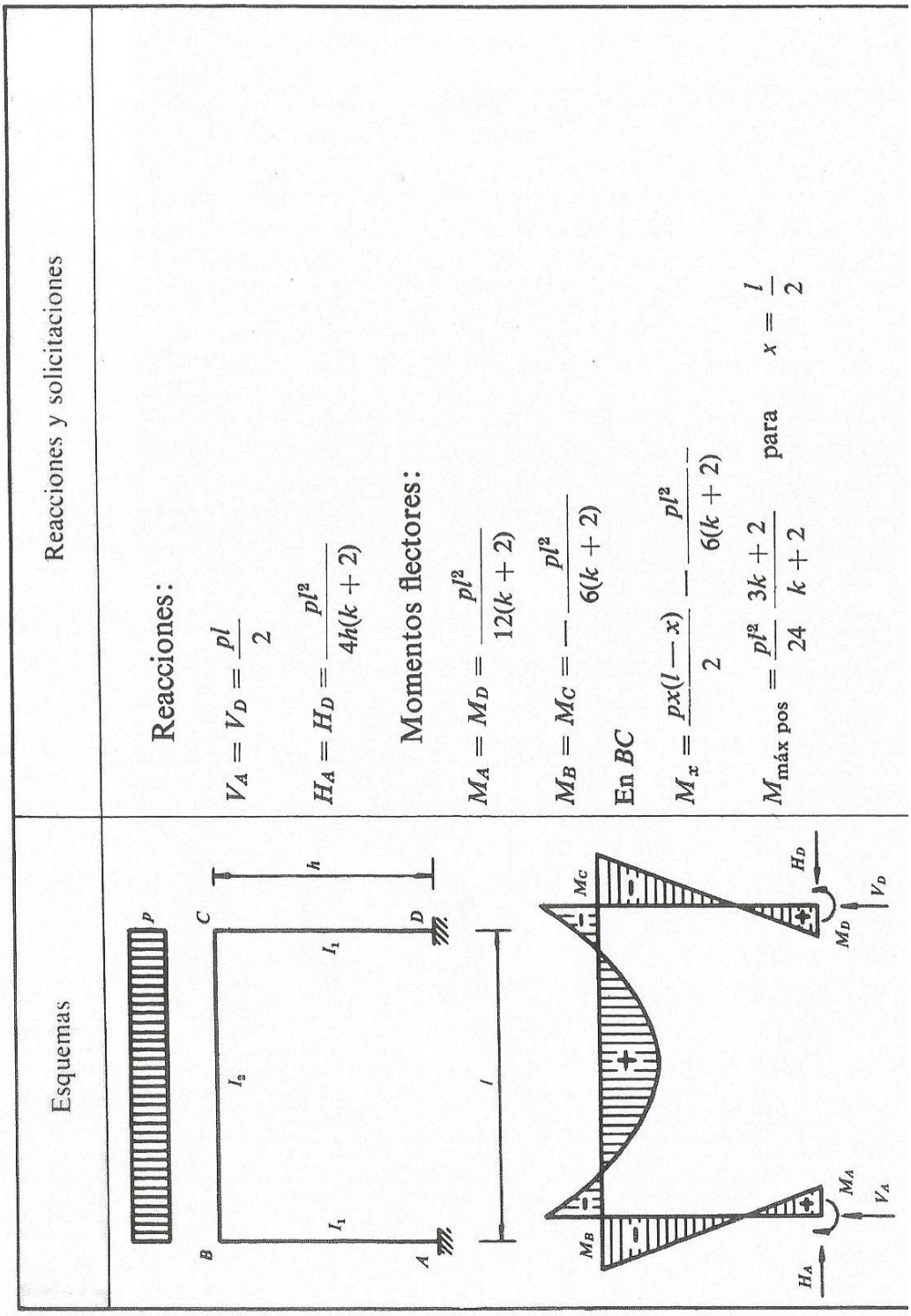
$$M_B = -\frac{3EI_2\alpha\,\Delta t}{h(k+1)} \frac{l^2 + h^2}{l^2}$$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

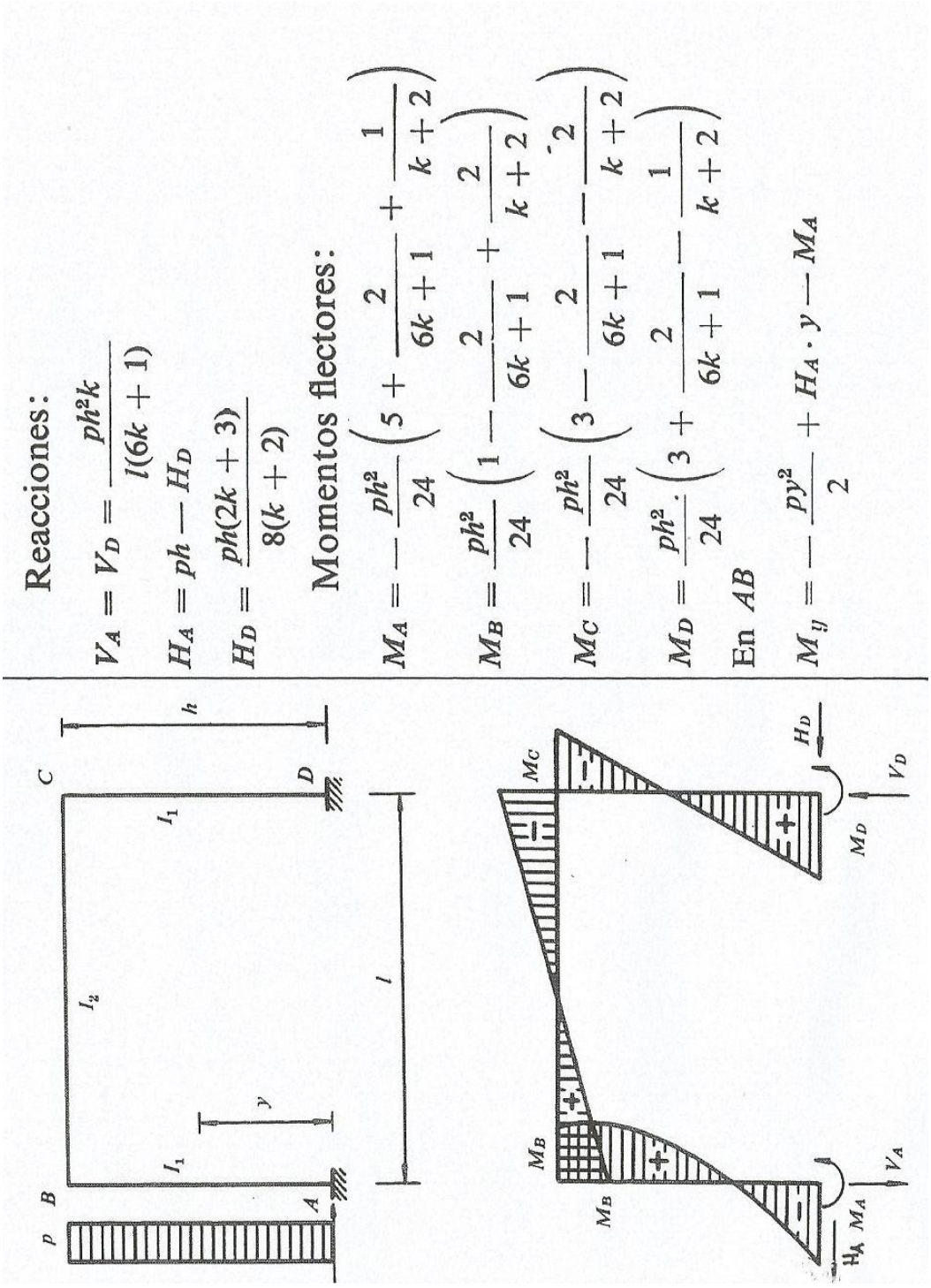
$$K = \frac{I_2}{I_1} \cdot \frac{h}{L}$$



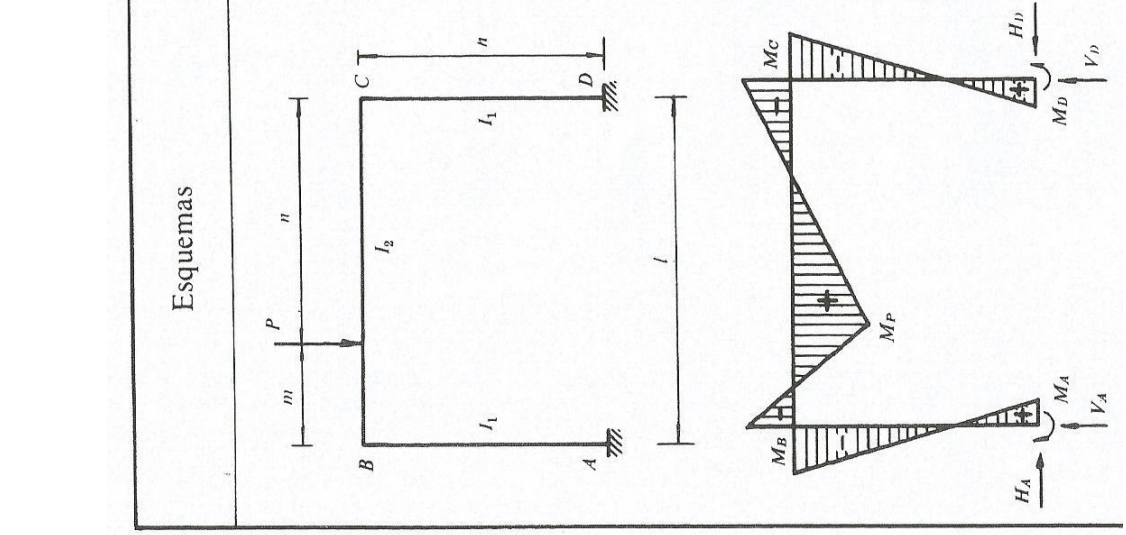
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{pl}{2}$ $H_A = H_D = \frac{pl^2}{4h(k+2)}$ Momentos flectores: $M_A = M_D = \frac{pl^2}{12(k+2)}$ $M_B = M_C = -\frac{pl^2}{6(k+2)}$ En BC $M_x = \frac{px(l-x)}{2} - \frac{pl^2}{6(k+2)}$ $M_{\text{máx pos}} = \frac{pl^2}{24}\frac{3k+2}{k+2}$ para $x = \frac{l}{2}$

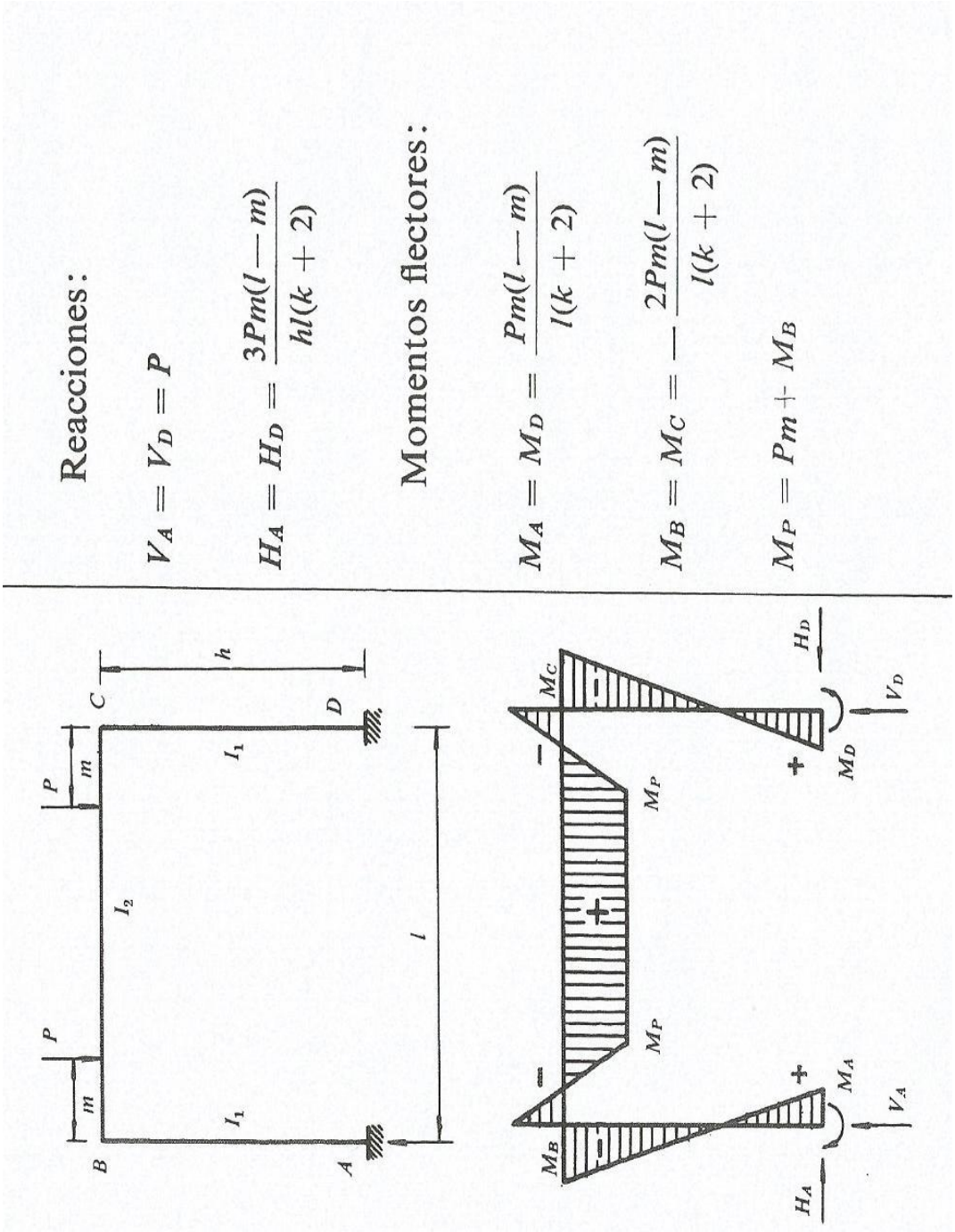
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL



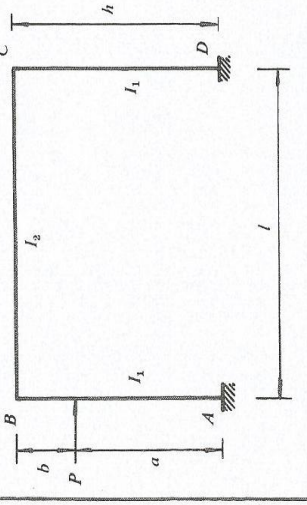
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{Pn}{l}\left(1 + \frac{m(n-m)}{l^2(6k+1)}\right)$ $V_D = P - V_A$ $H_A = H_D = \frac{3Pmn}{2lh(k+2)}$ Momentos flectores: $M_A = \frac{Pmn}{2l}\left(\frac{1}{k+2} - \frac{n-m}{l(6k+1)}\right)$ $M_B = -\frac{Pmn}{l}\left(\frac{1}{k+2} + \frac{n-m}{2l(6k+1)}\right)$ $M_C = -\frac{Pmn}{l}\left(\frac{1}{k+2} - \frac{n-m}{2l(6k+1)}\right)$ $M_D = \frac{Pmn}{2l}\left(\frac{1}{k+2} + \frac{n-m}{l(6k+1)}\right)$ $M_P = \frac{Pmn}{l} + \frac{nM_B}{l} + \frac{mM_C}{l}$

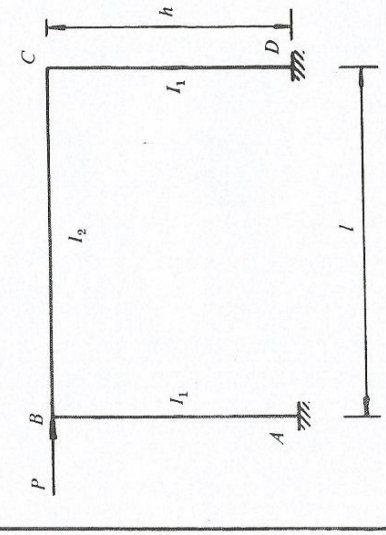
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL



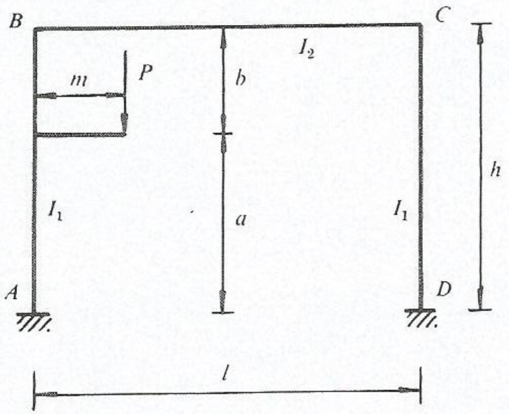
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

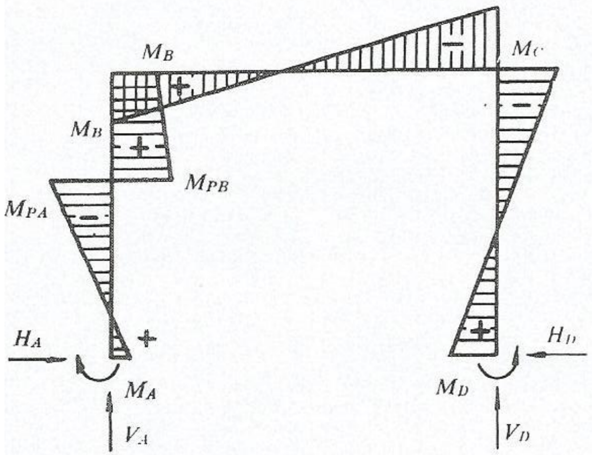
Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{3Pa^2k}{hl(6k+1)}$ $H_A = P - H_D$ $H_D = \frac{Pab}{2h^3}\left(\frac{h^2}{b} - \frac{h+b+(2b-h)k}{k+2}\right)$ Momentos flectores: $M_A = -\frac{Pa}{2h}\left(h + \frac{b(h+b+bk)}{h(k+2)} - \frac{3ak}{6k+1}\right)$ $M_B = \frac{Pa^2}{2h}\left(\frac{3k}{6k+1} - \frac{b}{h(k+2)}\right)$ $M_C = -\frac{Pa^2}{2h}\left(\frac{3k}{6k+1} + \frac{b}{h(k+2)}\right)$ $M_D = \frac{Pa}{2h}\left(h - \frac{b(h+b+bk)}{h(k+2)} - \frac{3ak}{6k+1}\right)$ $M_P = \frac{Pab}{h} + \frac{bM_A}{h} + \frac{aM_B}{h}$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{3Phk}{l(6k+1)}$ $H_A = H_D = \frac{P}{2}$ Momentos flectores: $M_A = -\frac{Ph}{2}\frac{3k+1}{6k+1}$ $M_B = -M_C = \frac{Ph}{2}\frac{3k}{6k+1}$ $M_D = \frac{Ph}{2}\frac{3k+1}{6k+1}$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL





Reacciones:

$$V_A = P - V_D$$

$$V_D = \frac{6Pmak}{hl(6k+1)}$$

$$H_A = H_B = \frac{3Pma}{2h^3} \frac{h + b + 2bk}{k+2}$$

Momentos flectores:

$$M_A = \frac{Pm}{2h^2(k+2)} [-3b^2 - h^2 + (h^2 - 3b^2 - 2ah)k] + \frac{3Pmak}{h(6k+1)}$$

$$M_B = \frac{Pmka}{h^2} \left(\frac{3h}{6k+1} + \frac{3a - 2h}{2(k+2)} \right)$$

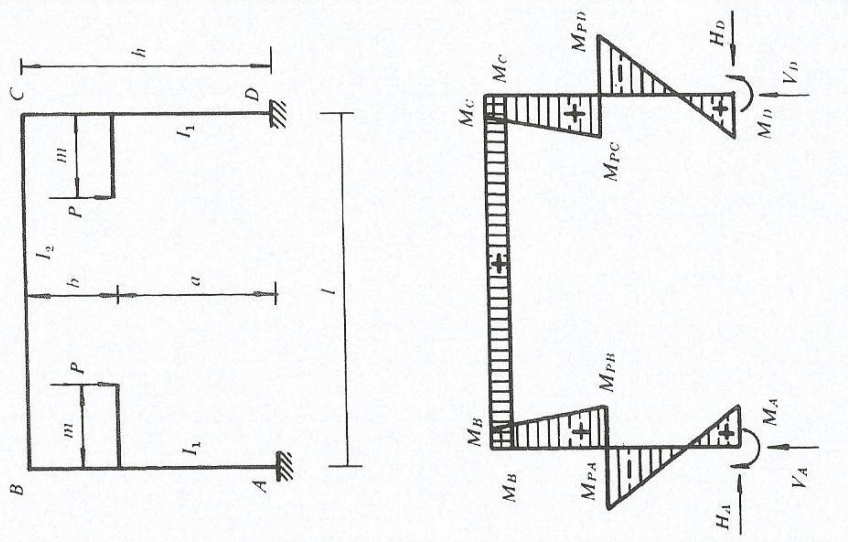
$$M_C = -\frac{Pmka}{h^2} \left(\frac{3h}{6k+1} - \frac{3a - 2h}{2(k+2)} \right)$$

$$M_D = \frac{Pm}{2h^2(k+2)} [3a(h+b) + a(3b+h)k] - 3 \frac{Pmak}{h(6k+1)}$$

$$M_{PA} = M_A - H_A \cdot a$$

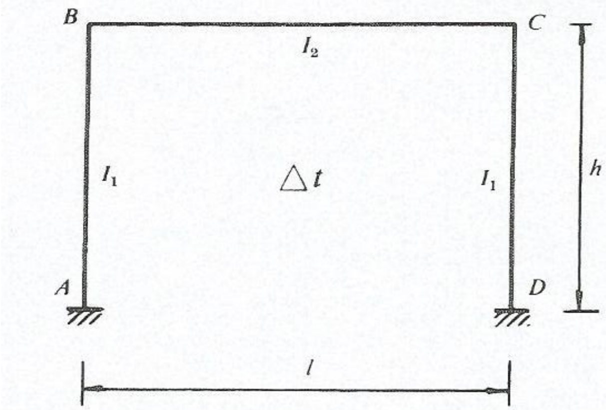
$$M_{PB} = M_B + H_D \cdot b$$

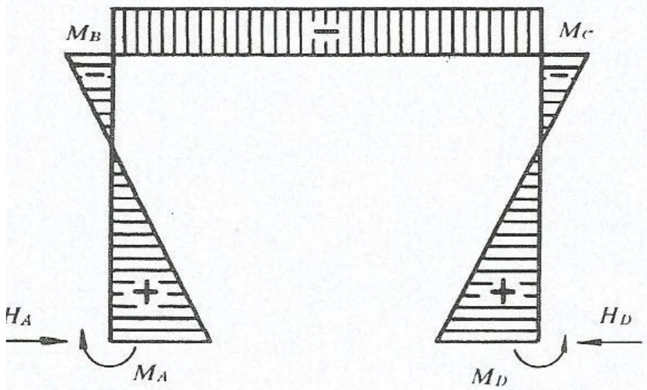
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = P$ $H_A = H_D = 3Pma\,\dfrac{h+b+2bk}{h^3(k+2)}$ Momentos flectores: $M_A = M_D = \dfrac{Pm}{h^2}\,\dfrac{h^2+2bhk-3b^2(k+1)}{k+2}$ $M_B = M_C = \dfrac{Pmka(3a-2h)}{h^2(k+2)}$ $M_{PA} = M_{PD} = M_A - H_A \cdot a$ $M_{PB} = M_{PC} = M_B + H_D \cdot b$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Aumento uniforme de temperatura





E = módulo de elasticidad

α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

Reacciones:

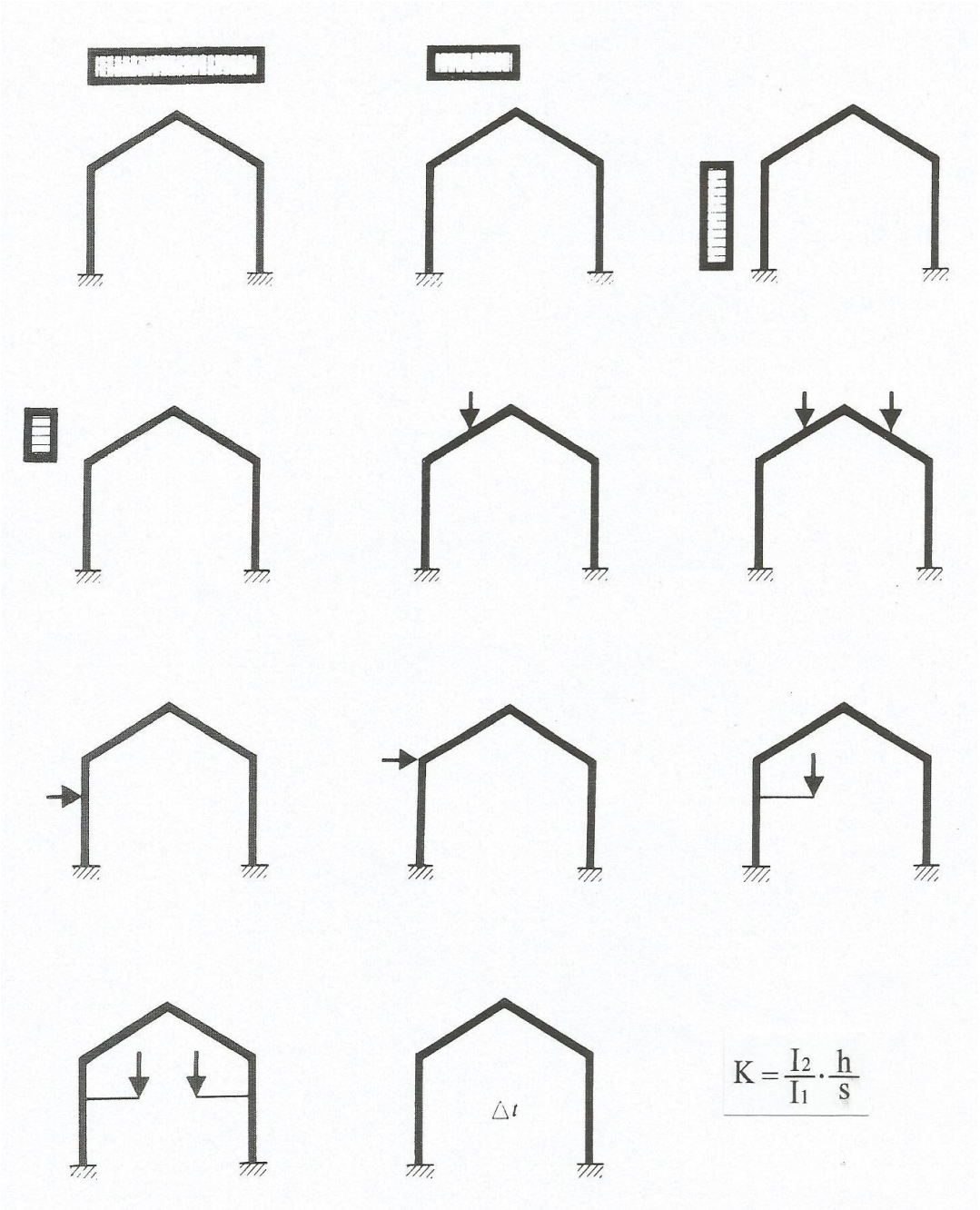
$$H_A = H_D = \frac{3EI_2\alpha\,\Delta t}{h^2k}\,\frac{2k+1}{k+2}$$

Momentos flectores:

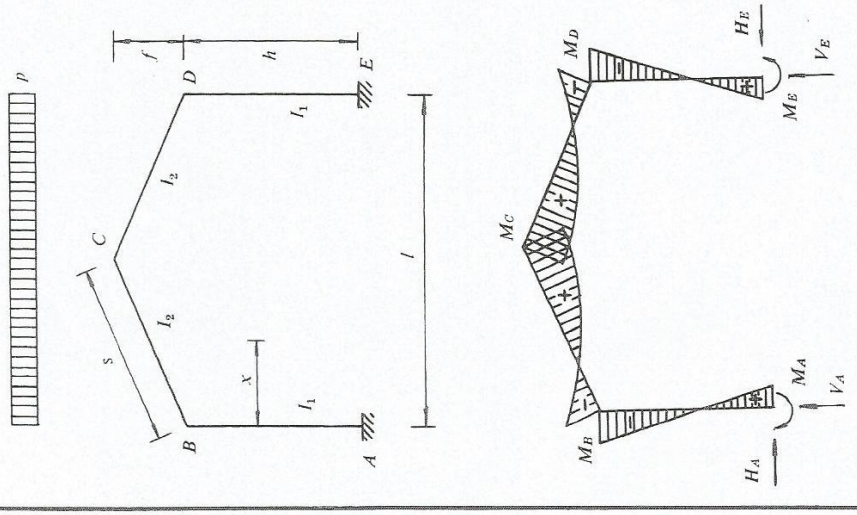
$$M_A = M_D = \frac{3EI_2\alpha\,\Delta t}{\cdot\,hk}\,\frac{k+1}{k+2}$$

$$M_B = M_C = -\frac{3EI_2\alpha\,\Delta t}{h(k+2)}$$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

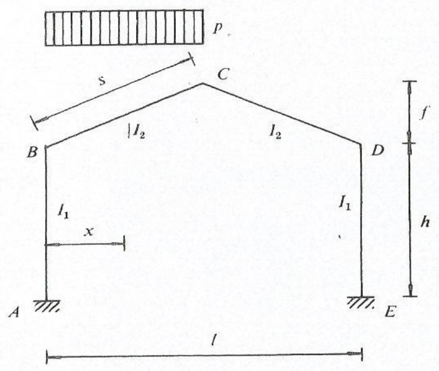


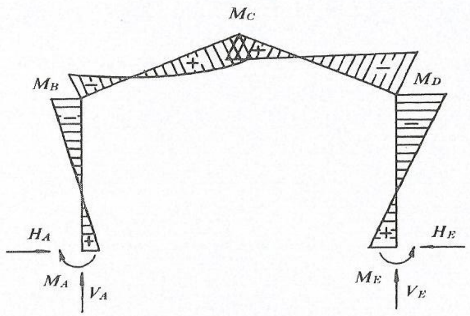
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_E = \frac{pl}{2}$ $H_A = H_E = \frac{pl^2}{8} \frac{k(4h + 5f) + f}{(kh + f)^2 + 4k(h^2 + hf + f^2)}$ Momentos flectores: $M_A = M_E = \frac{pl^2}{48} \frac{kh(8h + 15f) + f(6h - f)}{(kh + f)^2 + 4k(h^2 + hf + f^2)}$ $M_B = M_D = -\frac{pl^2}{48} \frac{kh(16h + 15f) + f^2}{(kh + f)^2 + 4k(f^2 + fh + h^2)}$ $M_C = \frac{pl^2}{8} + M_A - H_A(h + f)$ En BC $M_x = M_A + V_A \cdot x - H_A\left(h + \frac{2xf}{l}\right) - \frac{px^2}{2}$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas





Reacciones y solicitaciones

Reacciones:

$$V_A = \frac{pl}{2} - V_E$$

$$V_E = 3pl\,\frac{4k+1}{32(3k+1)}$$

$$H_A = H_E = \frac{pl^2}{16}\,\frac{k(4h+5f)+f}{(kh+f)^2+4k(h^2+hf+f^2)}$$

Momentos flectores:

$$M_A = \frac{pl^2}{96}\cdot\frac{kh(8h+15f)+f(6h-f)}{(kh+f)^2+4k(f^2+fh+h^2)} - \frac{pl^2}{64(3k+1)}$$

$$M_E = \frac{pl^2}{96}\,\frac{kh(8h+15f)+f(6h-f)}{(kh+f)^2+4k(f^2+fh+h^2)} + \frac{pl^2}{64(3k+1)}$$

$$M_B = -\frac{pl^2}{96}\,\frac{kh(16h+15f)+f^2}{(kh+f)^2+4k(f^2+fh+h^2)} - \frac{pl^2}{64(3k+1)}$$

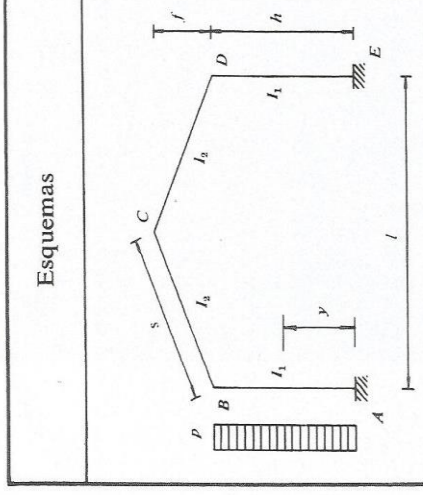
$$M_D = -\frac{pl^2}{96}\,\frac{kh(16h+15f)+f^2}{(kh+f)^2+4k(f^2+fh+h^2)} + \frac{pl^2}{64(3k+1)}$$

En BC

$$M_x = M_A + V_A\cdot x - H_A\left(h+\frac{2xf}{l}\right) - \frac{px^2}{2}$$

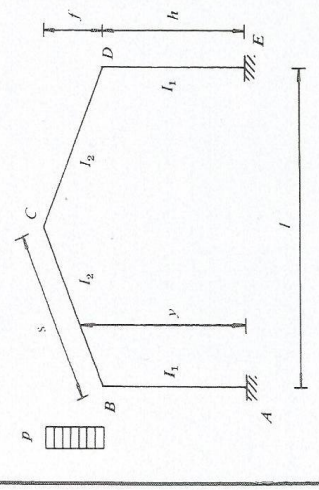
$$M_C = V_E\,\frac{l}{2} + M_E - H_E(f+h)$$

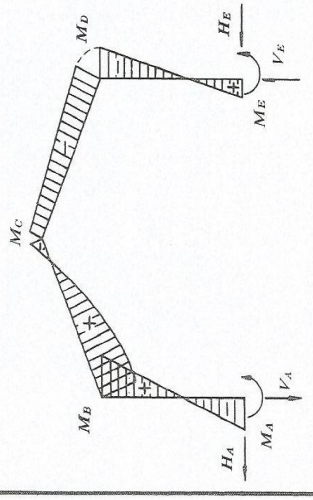
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_E = \frac{ph^2k}{2l(3k+1)}$ $H_A = ph - H_E$ $H_E = \frac{ph^2}{4}\frac{k^2h + k(2f+3h)}{(kh+f)^2 + 4k(f^2+fh+h^2)}$ Momentos flectores: $M_A = -\frac{ph^2}{24}\left(\frac{kh^2(k+6) + kf(15h+16f) + 6f^2}{(kh+f)^2 + 4k(f^2+fh+h^2)} + 6\frac{2k+1}{3k+1}\right)$ $M_B = M_A + H_A \cdot h - \frac{ph^2}{2}$ $M_C = M_E - H_E(f+h) + V_E\frac{l}{2}$ $M_D = M_E - H_E \cdot h$ $M_E = \frac{ph^2}{24}\left(-\frac{kh^2(k+6) + kf(15h+16f) + 6f^2}{(kh+f)^2 + 4k(f^2+fh+h^2)} + 6\frac{2k+1}{3k+1}\right)$ En AB $M_y = M_A + H_A \cdot y - \frac{py^2}{2}$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones





Reacciones:

$$V_A = V_E = \frac{3}{8}\frac{pf}{l}\frac{4k(f+h)+f}{3k+1}$$

$$H_A = pf - H_E$$

$$H_E = \frac{pf}{4}\frac{2kh^2(k+4)+f(10kh+5kf+f')}{(kh+f')^2+4k(f'^2+fh+h^2)}$$

Momentos flectores:

$$M_A = -\frac{pf}{24}\left(f\frac{kh(9f+4h)+f(6h+f')}{(kh+f')^2+4k(f'^2+fh+h^2)}+\right.$$
$$\left.+\frac{3}{2}\frac{4h(3k+2)+f}{3k+1}\right)$$

$$M_B = M_A + H_A \cdot h$$

$$M_C = M_E - H_E(h+f') + V_E\frac{l}{2}$$

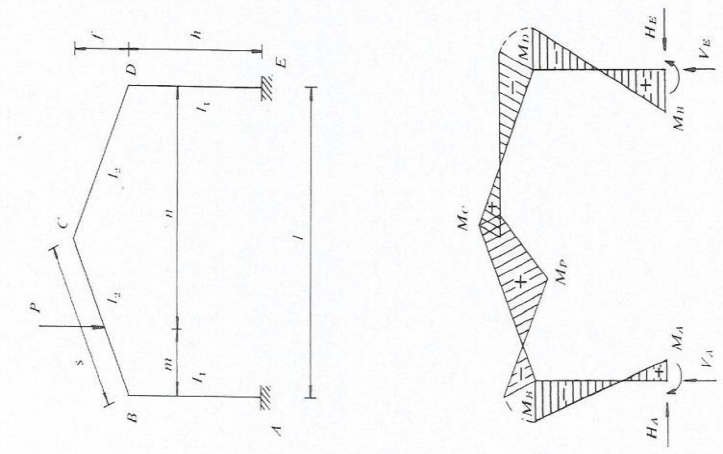
$$M_D = M_E - H_E \cdot h$$

$$M_E = \frac{pf}{24}\left(-f\frac{kh(9f+4h)+f(6h+f')}{(kh+f')^2+4k(f'^2+fh+h^2)}+\right.$$
$$\left.+\frac{3}{2}\frac{4h(3k+2)+f}{3k+1}\right)$$

En *BC*

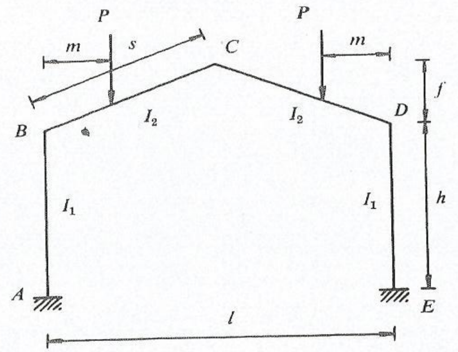
$$M_y = M_A + H_A \cdot y - V_A\frac{l(y-h)}{2f} - \frac{p(y-h)^2}{2}$$

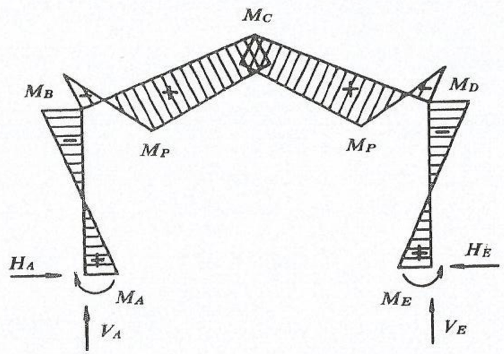
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = P - V_E$ $V_E = \frac{Pm}{l^3}\frac{3l(kl+m)-2m^2}{3k+1}$ $H_A = H_E = \frac{Pm}{l^2}\frac{3kl^2(f+h)-4fm^2(k+1)+3lm(f-kh)}{(kh+f)^2+4k(f^2+fh+h^2)}$ Momentos flectores: $M_A = \frac{Pm}{2l^2}\left(\frac{3flh(kl+2m)-4fm^2(kh+2h+f)}{(kh+f)^2+4k(f^2+fh+h^2)} + \frac{2kh^2ln+f^2l(4m-l)}{(kh+f)^2+4k(f^2+fh+h^2)} - \frac{n(n-m)}{3k+1}\right)$ $M_B = M_A - H_A \cdot h$ $M_C = M_E + V_E\frac{l}{2} - H_E(h+f)$ $M_D = M_E - H_E \cdot h$ $M_E = \frac{Pm}{2l^2}\left(\frac{3flh(kl+2m)+4fm^2(kh+2h+f)}{(kh+f)^2+4k(f^2+fh+h^2)} + \frac{2kh^2ln+f^2l(4m-l)}{(kh+f)^2+4k(f^2+fh+h^2)} + \frac{n(n-m)}{3k+1}\right)$ $M_P = M_A + V_A \cdot m - H_A\left(h+\frac{2fm}{l}\right)$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas





Reacciones y solicitaciones

Reacciones:

$$V_A = V_E = P$$

$$H_A = H_E = \frac{2Pm}{l^2} \frac{3kl^2(f + h) - 4fm^2(k + 1) + 3lm(f - kh)}{(kh + f)^2 + 4k(f^2 + fh + h^2)}$$

Momentos flectores:

$$M_A = M_E = \frac{Pm}{l^2} \frac{3flh(kl + 2m) - 4fm^2(kh + 2h + f)}{(kh + f)^2 + 4k(f^2 + fh + h^2)} +$$

$$+ \frac{2kh^2ln + f^2l(4m - l)}{(kh + f)^2 + 4k(f^2 + fh + h^2)}$$

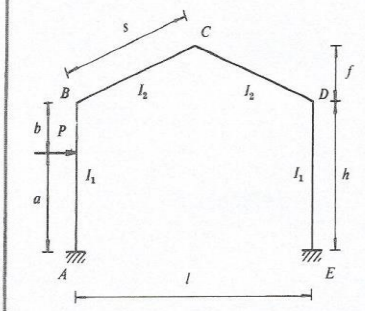
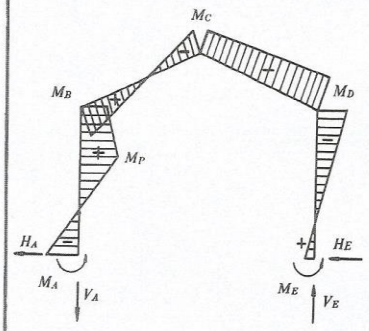
$$M_B = M_A - H_A \cdot h$$

$$M_C = M_E - H_E(h + f) + Pm$$

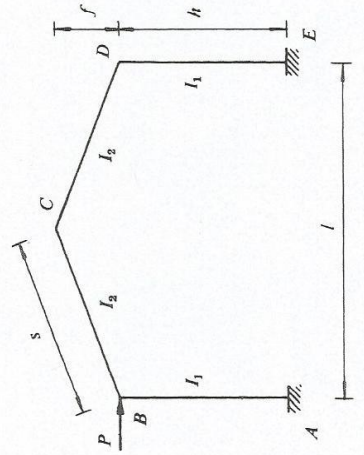
$$M_D = M_E - H_E \cdot h$$

$$M_P = M_A + V_A \cdot m - H_A \left(h + \frac{2fm}{l}\right)$$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones:
	$V_A = V_E = \frac{Pa}{l} + \frac{M_A - M_E}{l}$
	$H_A = P - H_E$
	$H_E = \frac{Pa^2k}{2h} \frac{k(3h-2a)+6h+3f-2a}{(kh+f)^2+4k(h^2+hf+f^2)}$
	Momentos flectores:
	$M_A = -\frac{Pa}{2h}\left(\frac{kh^2(4h+kh-2ka-6a+6f)}{(kh+f)^2+4k(h^2+hf+f^2)} + \frac{ka^2(kh+2h+f)+2kf(2hf-af-3ah)+hf^2}{(kh+f)^2+4k(h^2+hf+f^2)} + \frac{2h+3k(2h-a)}{2(3k+1)}\right)$
	$M_E = \frac{Pa}{2h}\left(-\frac{kh^2(4h+kh-2ka-6a+6f)}{(kh+f)^2+4k(h^2+hf+f^2)} + \frac{ka^2(kh+2h+f)-2kf(2hf-af-3ah)+hf^2}{(kh+f)^2+4k(h^2+hf+f^2)} + \frac{2h+3k(2h-a)}{2(3k+1)}\right)$
	$M_B = M_A + H_A \cdot h - P(h-a)$
	$M_C = M_E + V_E \frac{l}{2} - H_E(h+f)$
	$M_D = M_E - H_E \cdot h$
	$M_P = M_A + H_A \cdot a$

PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones:

$$V_A = V_E = \frac{Ph}{l} + \frac{M_A - M_E}{l}$$

$$H_A = P - H_E$$

$$H_E = \frac{P}{2}\, kh\, \frac{kh + 4h + 3f}{(kh + f')^2 + 4k(h^2 + hf + f'^2)}$$

Momentos flectores:

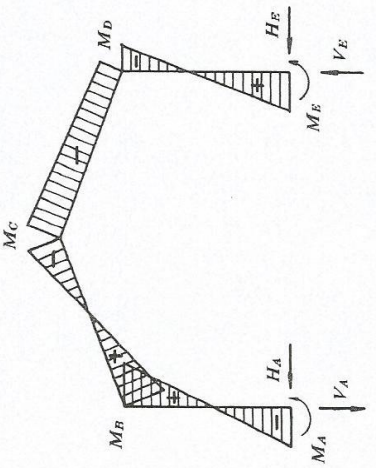
$$M_A = -\frac{Ph}{2}\left(\frac{f(kh + 2kf + f')}{(kh + f')^2 + 4k(h^2 + hf + f'^2)} + \frac{3k + 2}{2(3k + 1)}\right)$$

$$M_E = \frac{Ph}{2}\left(-\frac{f(kh + 2kf + f')}{(kh + f')^2 + 4k(h^2 + hf + f'^2)} + \frac{3k + 2}{2(3k + 1)}\right)$$

$$M_B = M_A + H_A \cdot h$$

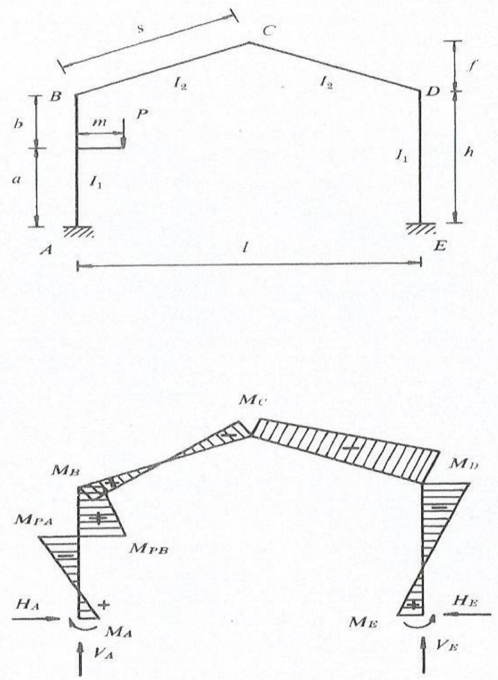
$$M_C = M_E + V_E \frac{l}{2} - H_E(h + f')$$

$$M_D = M_E - H_E \cdot h$$



PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas



Reacciones y solicitaciones

Reacciones:

$$V_A = P - V_E$$

$$V_E = \frac{Pm}{l} \frac{3ka}{1 + 3k}$$

$$H_A = \frac{3Pmk}{h} \frac{h(h + f + kb) - b(f + b + kb)}{(kh + f)^2 + 4k(h^2 + hf + f^2)}$$

Momentos flectores:

$$M_A = \frac{Pm}{2h}\left(\frac{-f^2h + kh^2(2h + 3f + 2kb)}{(kh + f)^2 + 4k(h^2 + hf + f^2)} - \right.$$
$$\left. - \frac{kbf(6h + 3b + 4f) - 3kb^2h(k + 2)}{(kh + f)^2 + 4k(h^2 + hf + f^2)} - \frac{h + 3kb}{1 + 3k}\right)$$

$$M_E = \frac{Pm}{2h}\left(\frac{-f^2h + kh^2(2h + 3f + 2kb)}{(kh + f)^2 + 4k(h^2 + hf + f^2)} - \right.$$
$$\left. - \frac{kbf(6h + 3b + 4f) - 3kb^2h(k + 2)}{(kh + f)^2 + 4k(h^2 + hf + f^2)} + \frac{h + 3kb}{1 + 3k}\right)$$

$$M_B = M_A - H_A \cdot h + Pm$$

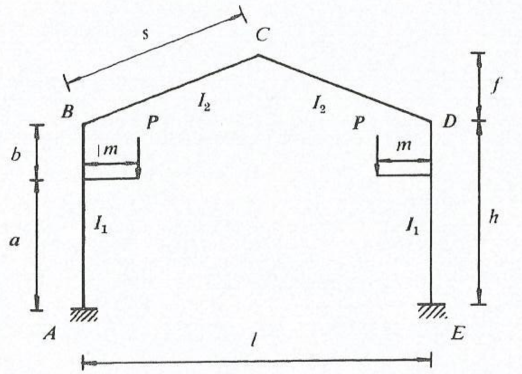
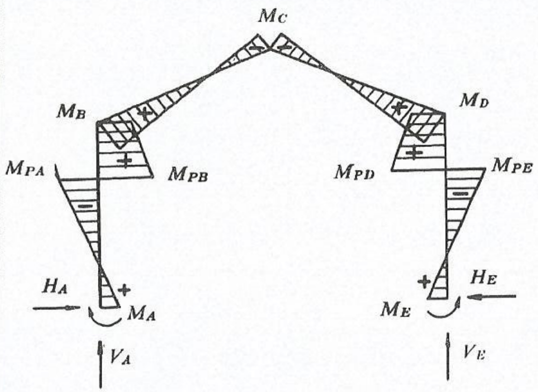
$$M_D = M_E - H_E \cdot h$$

$$M_C = M_E - H_E(h + f) + V_E \frac{l}{2}$$

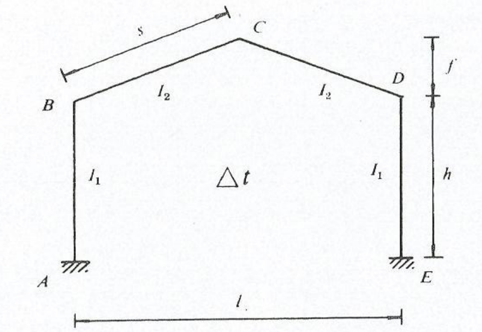
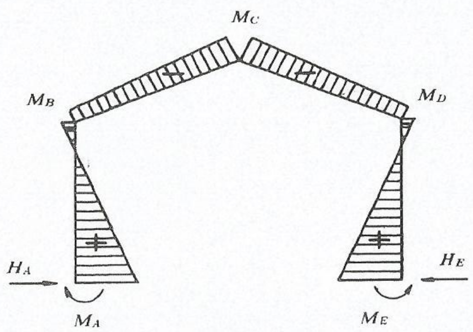
$$M_{PA} = M_A - H_A \cdot a$$

$$M_{PB} = M_A - H_A \cdot a + Pm$$

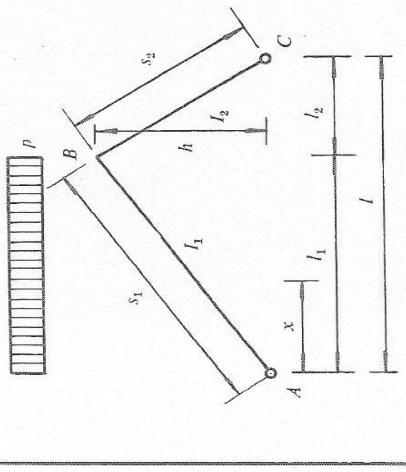
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = V_E = P$ $H_A = H_E = \dfrac{6Pmk}{h} \dfrac{h(h+f+kb) - b(f+b+kb)}{(kh+f)^2 + 4k(h^2+hf+f^2)}$ **Momentos flectores:** $M_A = M_E = \dfrac{Pm}{h}\left(\dfrac{-f^2h + kh^2(2h+3f+2kb)}{(kh+f)^2 + 4k(h^2+hf+f^2)} - \dfrac{kbf(6h+3b+4f) + 3kb^2h(k+2)}{(kh+f)^2+4k(h^2+hf+f^2)}\right)$
	$M_B = M_D = M_A - H_A \cdot h + Pm$ $M_C = M_A - H_A(h+f) + Pm$ $M_{PA} = M_{P'E} = M_A - H_A \cdot a$ $M_{PB} = M_{P'D} = M_A - H_A \cdot a + Pm$

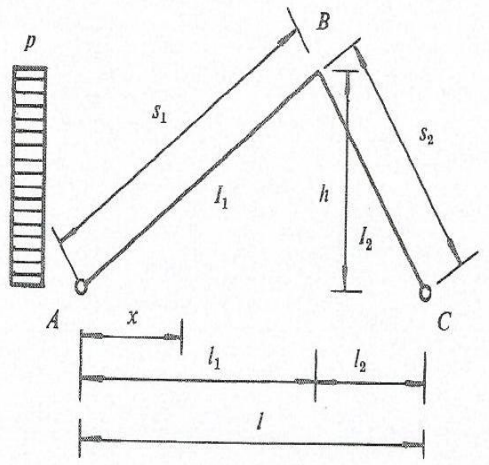
PÓRTICOS SIMPLES BIEMPOTRADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
Aumento uniforme de temperatura  	E = módulo de elasticidad α = coeficiente de dilatación térmica Δt = variación de la temperatura en grados $H_A = H_E = \dfrac{6EI_2\alpha\,\Delta t\, l(k+1)}{s[(kh+f)^2+4k(h^2+hf+f^2)]}$ Momentos flectores: $M_A = M_E = \dfrac{3EI_2\alpha\,\Delta t\, l(kh+2h+f)}{s[(kh+f)^2+4k(h^2+hf+f^2)]}$ $M_B = M_D = \dfrac{3EI_2\alpha\,\Delta t\, l(kh-f)}{s[(kh+f)^2+4k(h^2+hf+f^2)]}$ $M_C = -\dfrac{3EI_2\alpha\,\Delta t\, l(kh+f)}{s[(kh+f)^2+4k(h^2+hf+f^2)]}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRIANGULARES

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{pl_1}{2l}(l + l_2)$ $V_C = \frac{pl_1^2}{2l}$ $H_A = H_C = \frac{pl_1^2}{8hl}\,\frac{4l_2 + k(4l_2 + l)}{1 + k}$ Momentos flectores: $M_B = -\frac{pl_1^2 k}{8(1 + k)}$ En AB $M_x = \frac{px(l_1 - x)}{2} + \frac{x}{l_1} M_B$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRIANGULARES

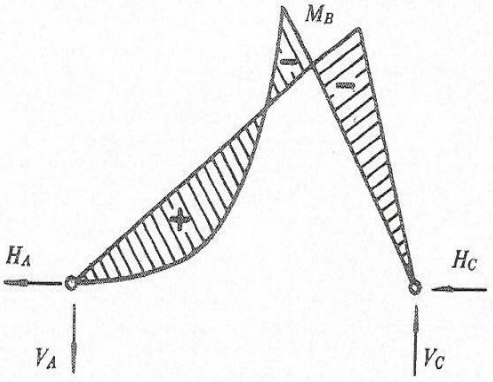


Reacciones:

$$V_A = V_C = \frac{ph^2}{2l}$$

$$H_A = ph - H_C$$

$$H_C = \frac{ph}{8l}\,\frac{4l_2 + k(4l_2 + l)}{1 + k}$$



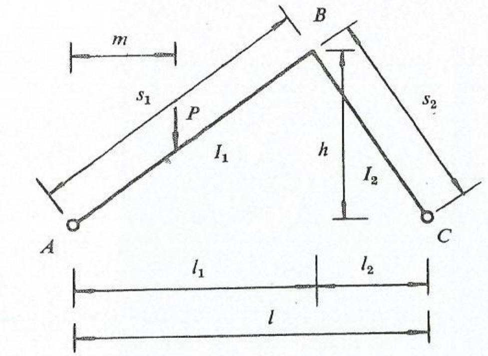
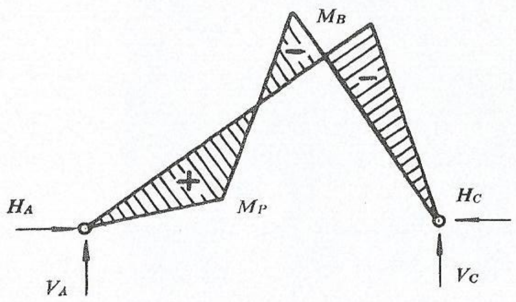
Momentos flectores:

$$M_B = -\frac{ph^2k}{8(1+k)}$$

En AB

$$M_x = \frac{px(l_1 - x)}{2}\,\frac{h^2}{l_1^2} + \frac{x}{l_1}M_B$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRIANGULARES

<table>
<tr><th>Esquemas</th><th>Reacciones y solicitaciones</th></tr>
<tr><td> 
  </td><td>Reacciones:

$V_A = P \dfrac{l - m}{l}$

$V_C = P \dfrac{m}{l}$

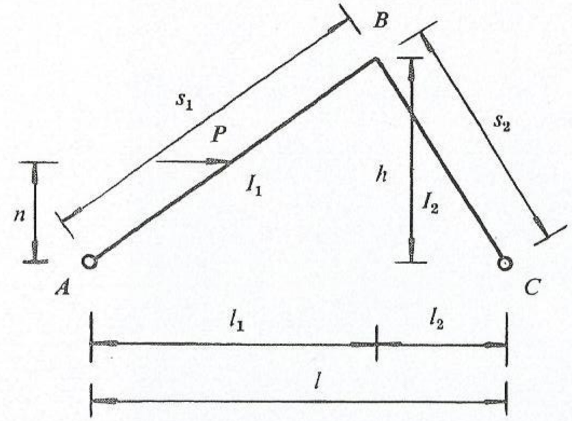
$H_A = \dfrac{Pm}{2hl} \dfrac{2l_2 l_1^2 + k(2l_2 l_1^2 + l_1^2 l - m^2 l)}{l_1^2(1 + k)}$

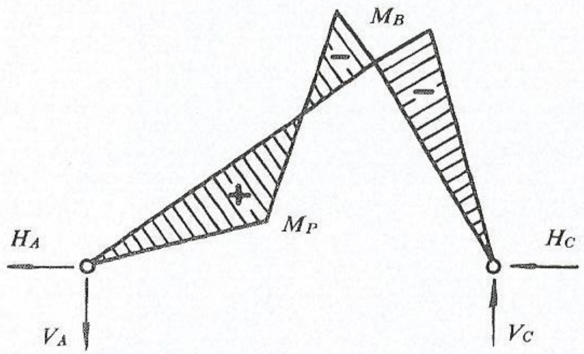
Momentos flectores:

$M_B = - Pm \dfrac{k(l_1^2 - m^2)}{2l_1^2(1 + k)}$

$M_P = \dfrac{Pm}{l}(l - m) - H_A \dfrac{mh}{l_1}$</td></tr>
</table>

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA TRIANGULARES





Reacciones:

$$V_A = V_C = \frac{Pn}{l}$$

$$H_A = P - H_C$$

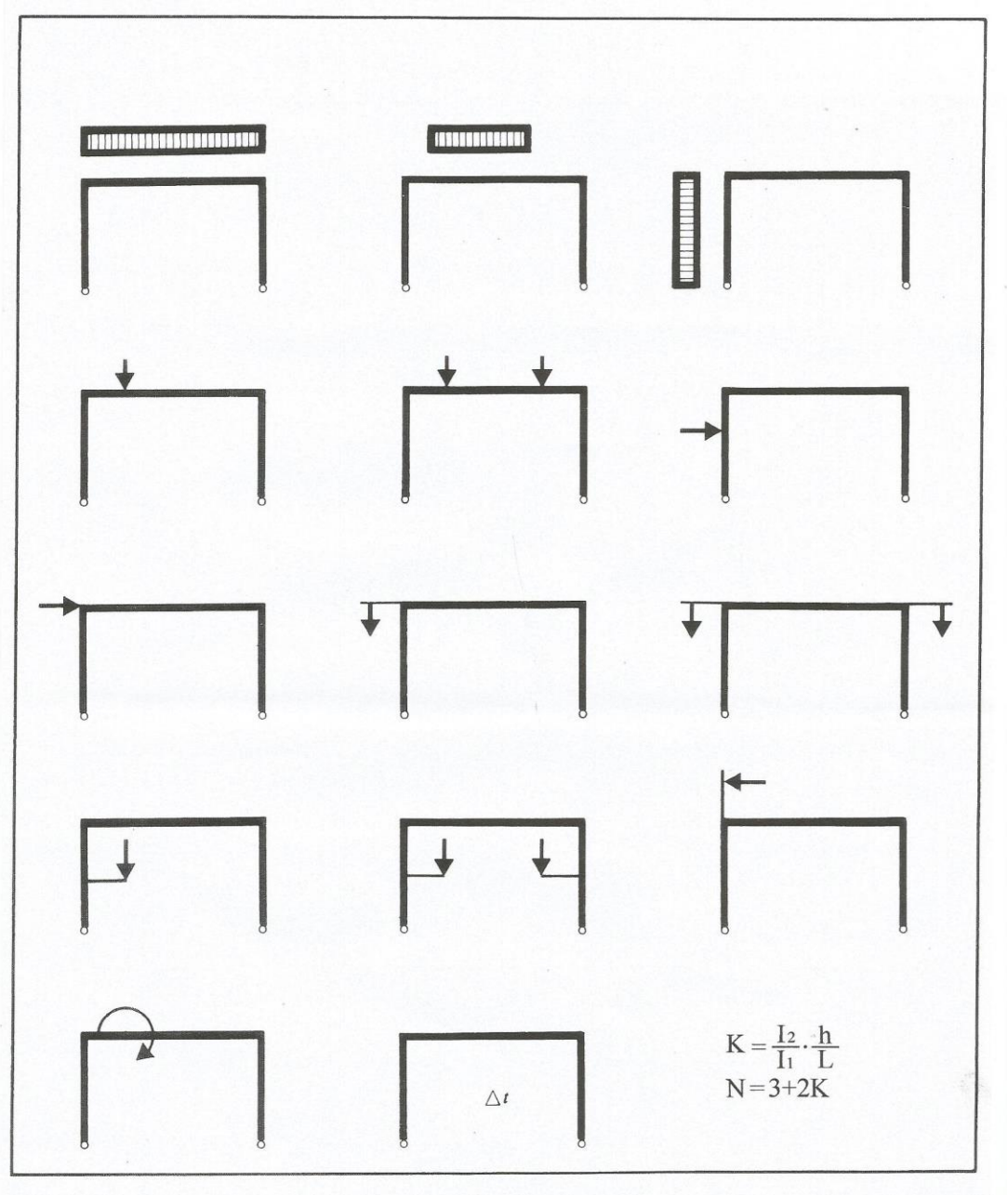
$$H_C = \frac{Pn}{2h^3 l} \frac{2h^2 l_2 + k(2h^2 l_2 + lh^2 - n^2 l)}{1 + k}$$

Momentos flectores:

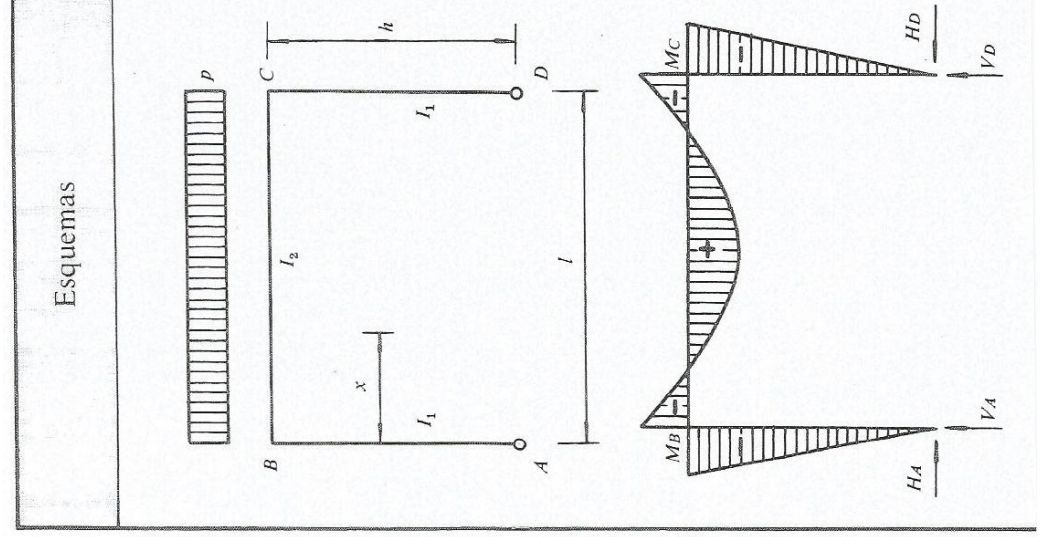
$$M_B = -\frac{Pnk(h^2 - n^2)}{2h^2(1 + k)}$$

$$M_P = \frac{Pn^2 l_1}{lh} + H_A \cdot n$$

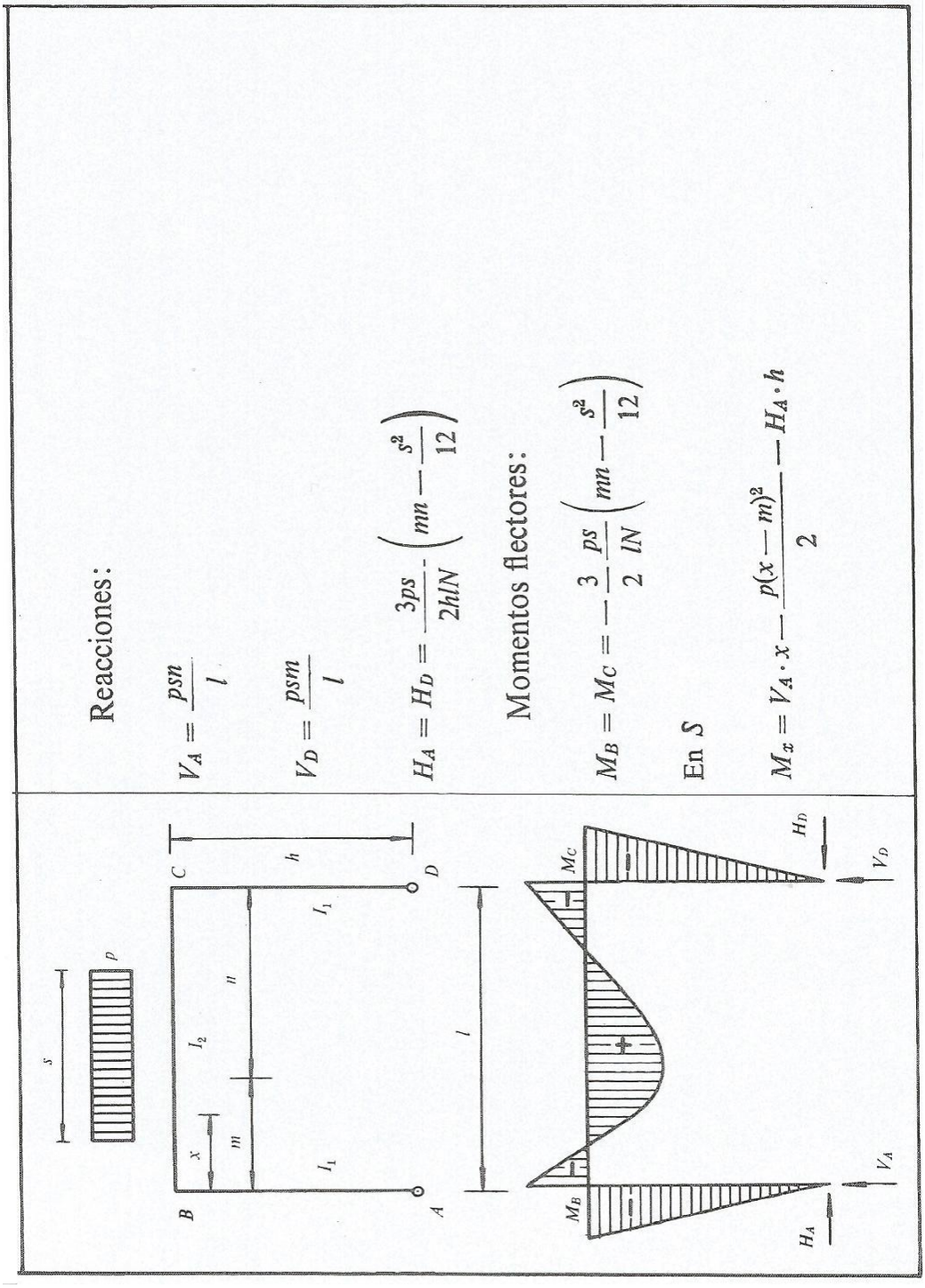
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL



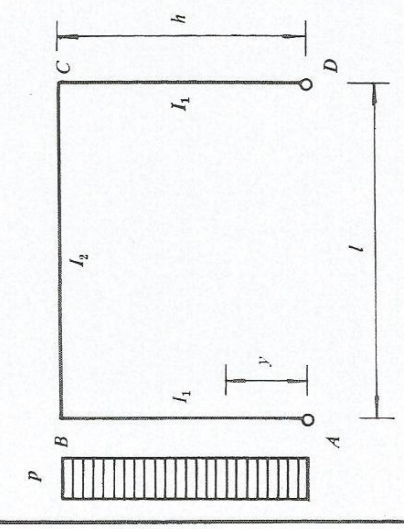
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	**Reacciones:** $V_A = V_D = \frac{pl}{2}$ $H_A = H_D = \frac{pl^2}{4hN}$ **Momentos flectores:** $M_B = M_C = -\frac{pl^2}{4N}$ $M_x = \frac{px(l-x)}{2} - \frac{pl^2}{4N}$ $M_{máx\ pos.} = \frac{pl^2}{8} - \frac{pl^2}{4N}$ para $x = \frac{l}{2}$

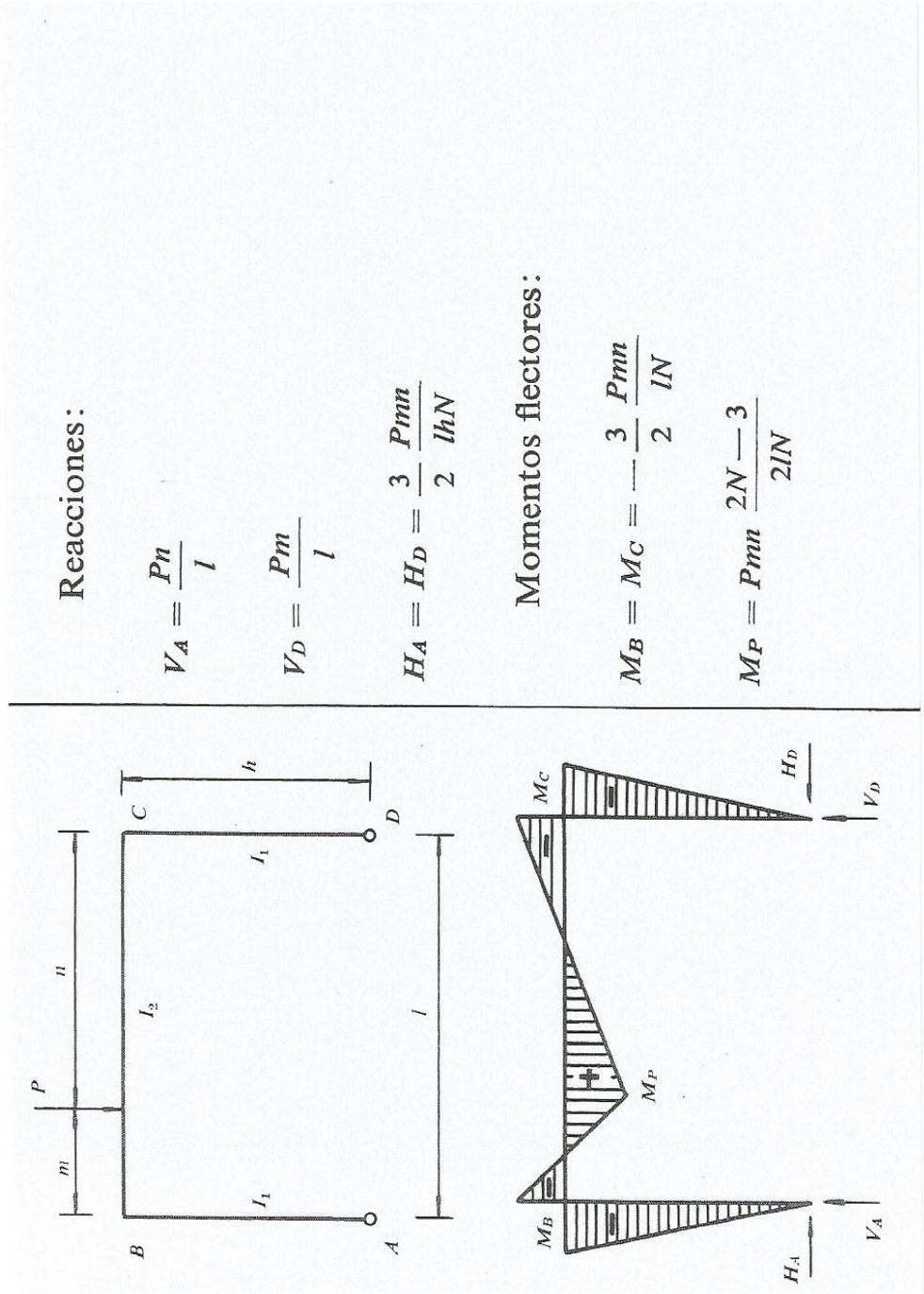
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL



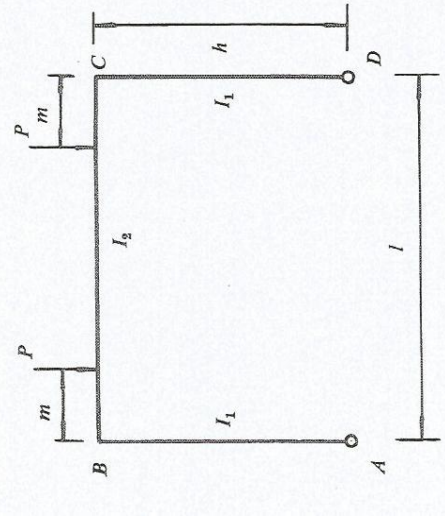
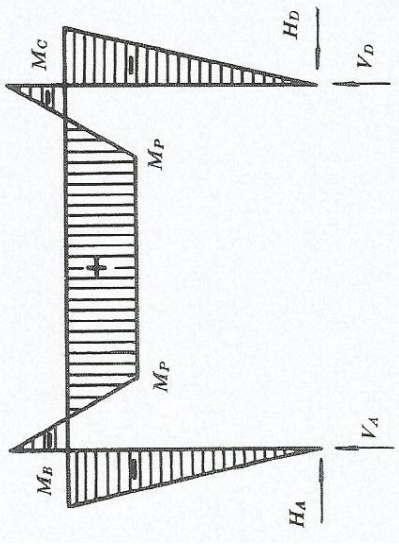
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{ph^2}{2l}$ $H_D = \frac{ph(2N+k)}{8N}$ $H_A = \frac{ph(6N-k)}{8N}$ Momentos flectores: $M_B = \frac{ph^2}{8N}(2N-k)$ $M_C = -\frac{ph^2}{8N}(2N+k)$ En AB $M_y = \frac{py(h-y)}{2} + \frac{y}{h}M_B$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL



PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = P$ $H_A = H_D = 3\dfrac{Pm(l - m)}{Nlh}$ Momentos flectores: $M_B = M_C = -3\dfrac{Pm(l - m)}{Nl}$ $M_P = Pm + M_B$
	

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Reacciones:

$$V_A = V_D = \frac{Pa}{l}$$

$$H_A = P - H_D$$

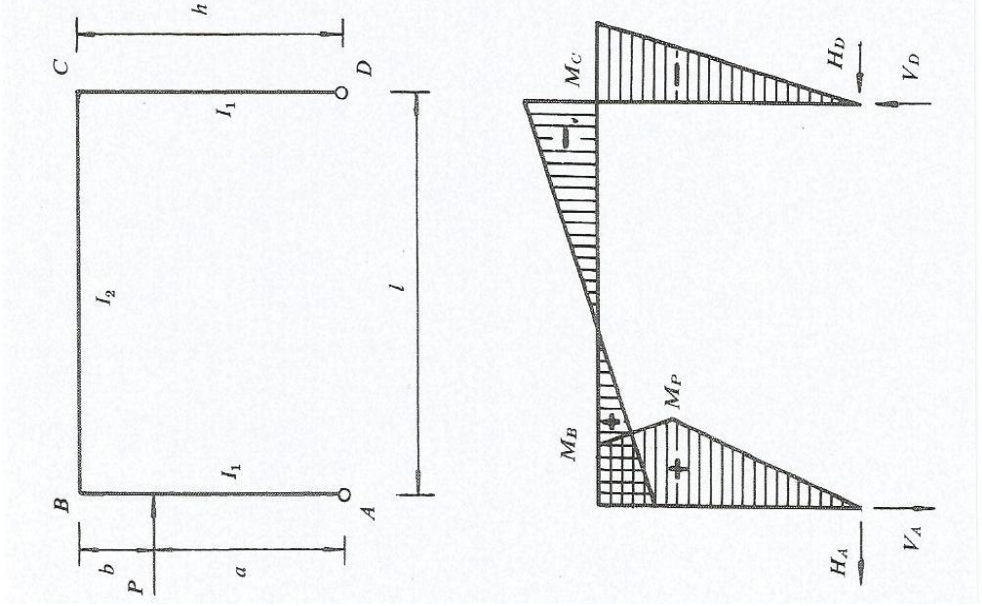
$$H_D = \frac{Pa}{2}\,\frac{Nh^2 + (a + h)bk}{Nh^3}$$

Momentos flectores:

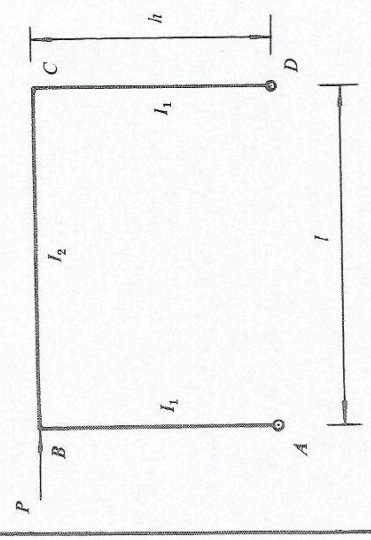
$$M_B = \frac{Pa}{2}\,\frac{Nh^2 - (a + h)bk}{Nh^2}$$

$$M_C = -\frac{Pa}{2}\,\frac{Nh^2 + (a + h)bk}{Nh^2}$$

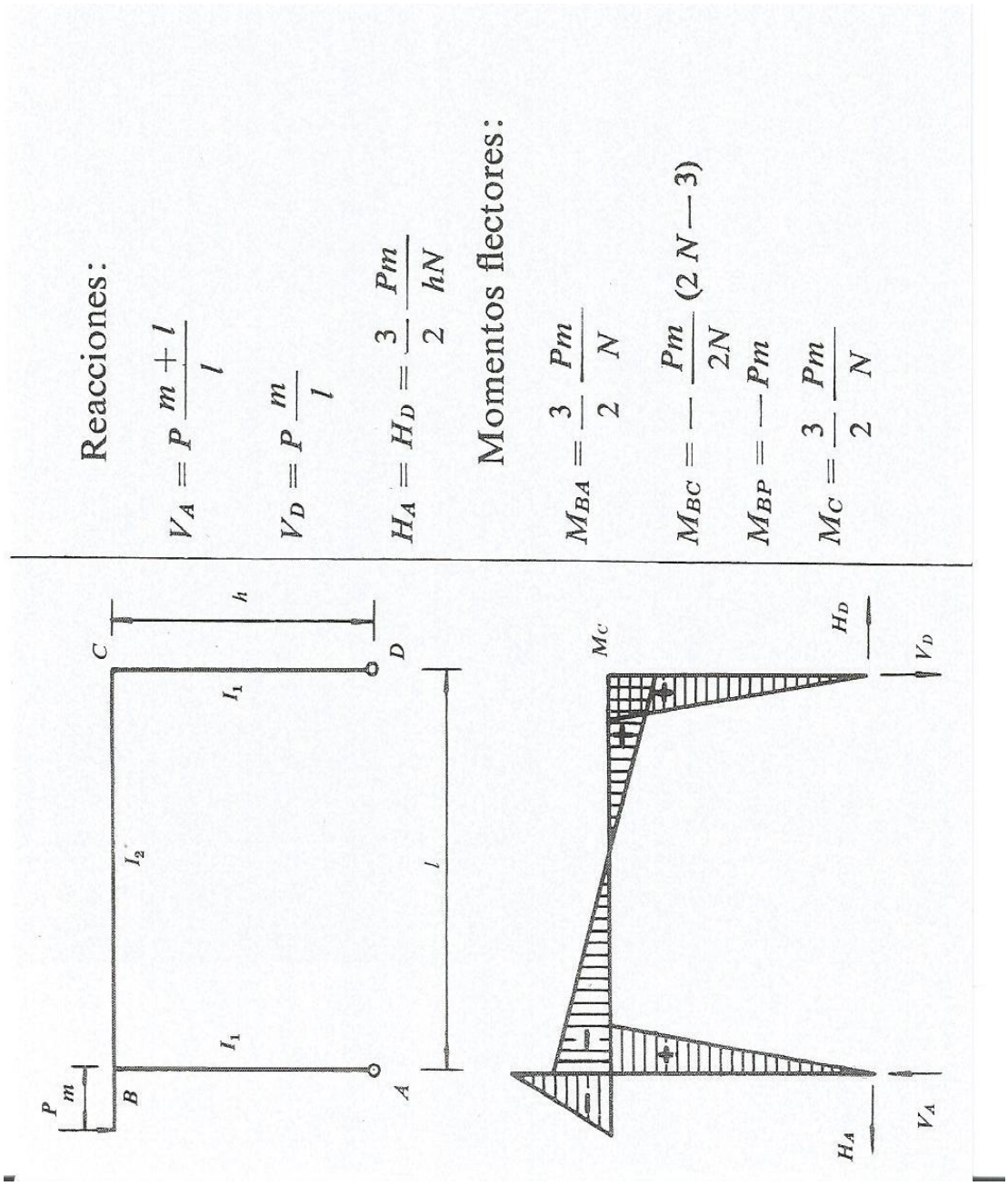
$$M_P = \frac{a}{h}(Pb + M_B)$$



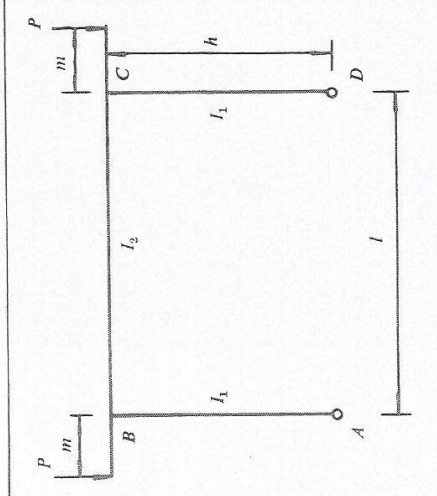
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{Ph}{l}$ $H_A = H_D = \frac{P}{2}$ Momentos flectores: $M_B = -M_C = \frac{Ph}{2}$

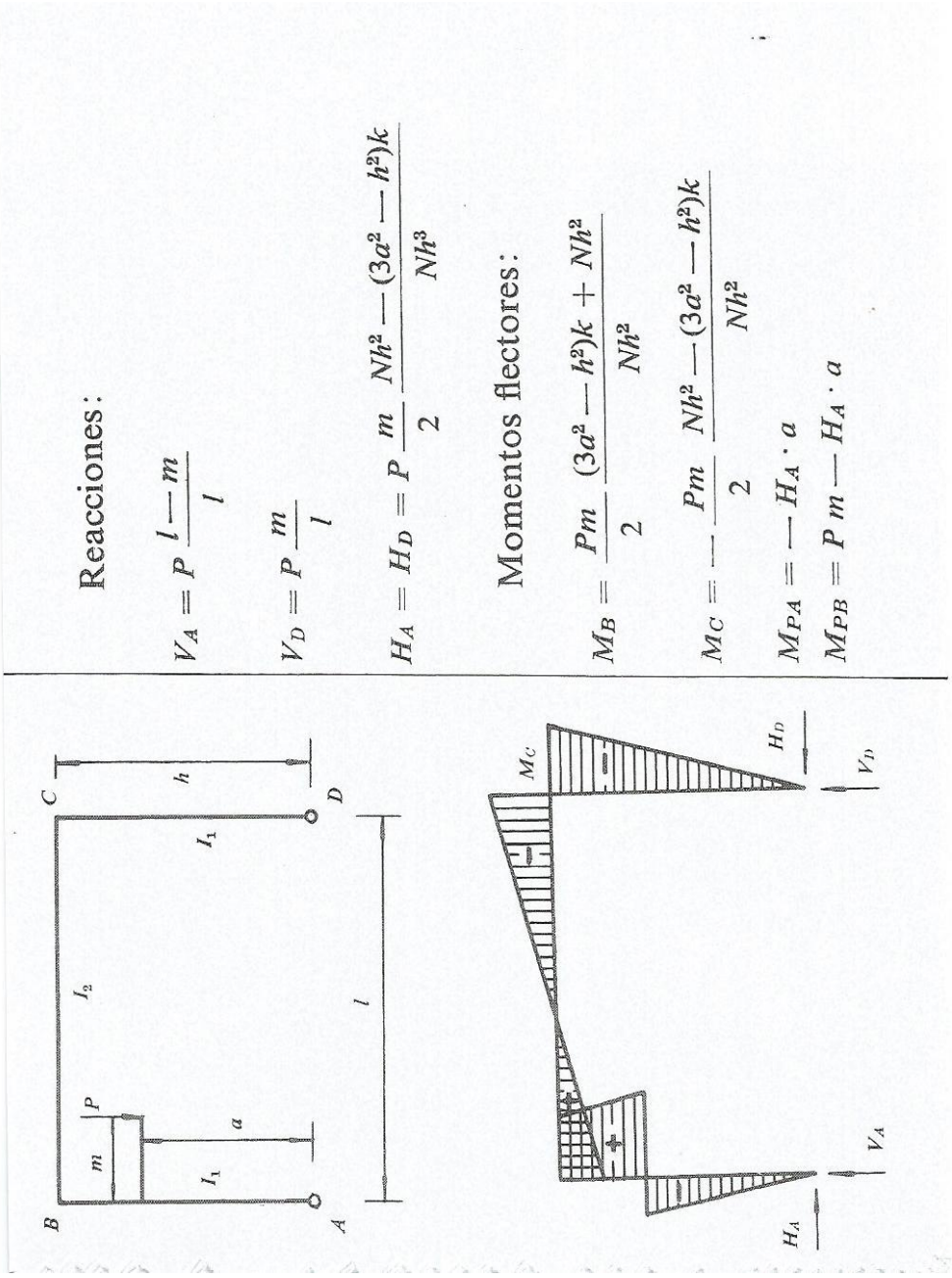
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL



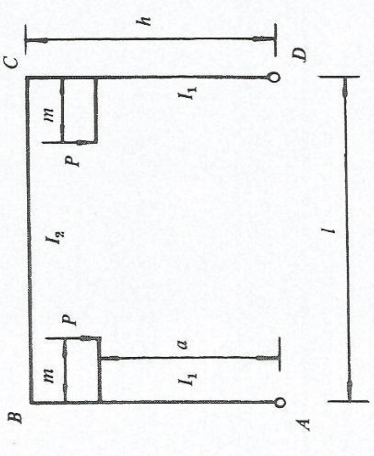
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = P$ $H_A = H_D = 3\,\frac{Pm}{hN}$ Momentos flectores: $M_{BA} = M_{CD} = 3\,\frac{Pm}{N}$ $M_{BC} = M_{CB} = -\,\frac{Pm}{N}\,(N-3)$ $M_{BP} = M_{CP} = -Pm$

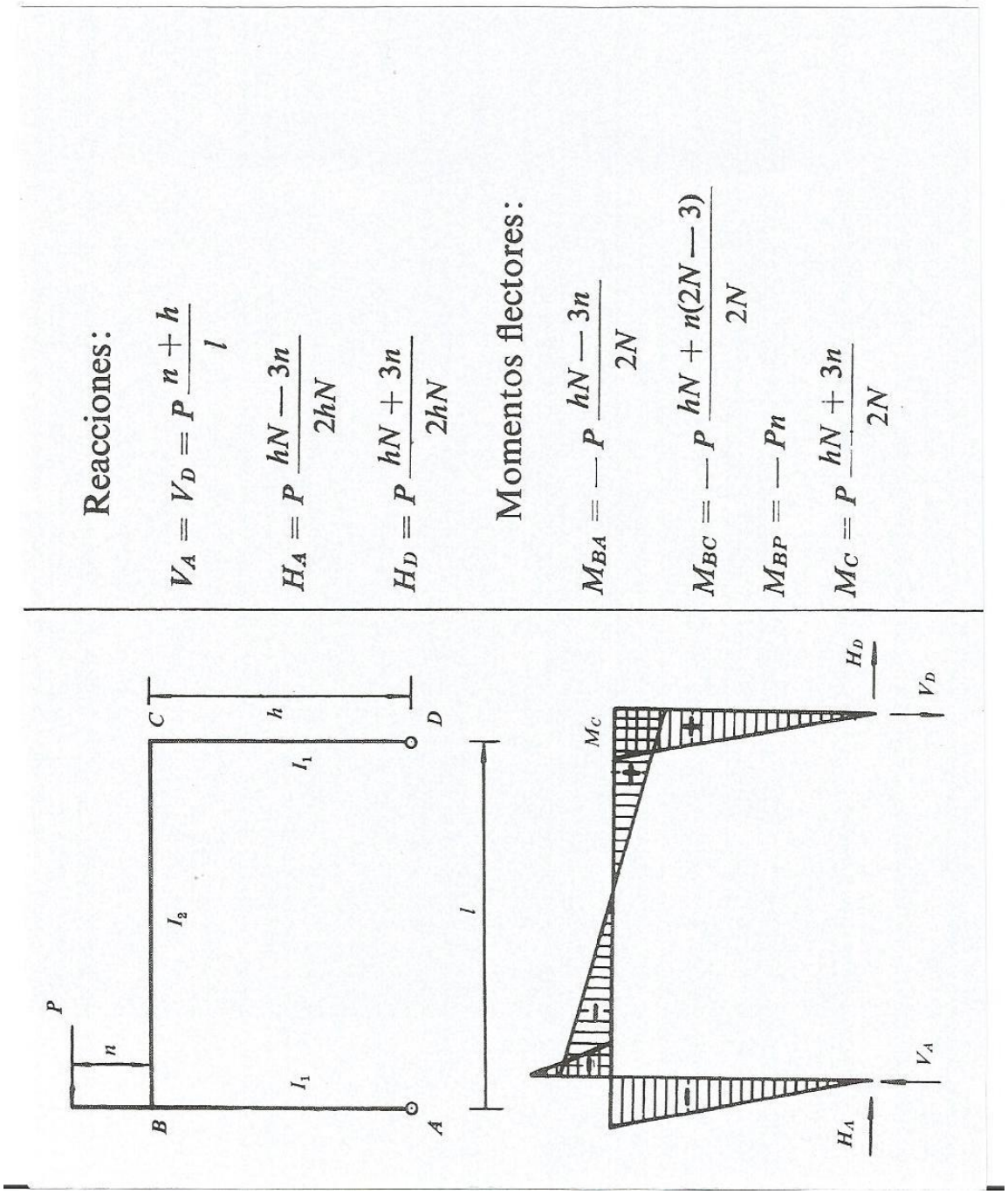
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL



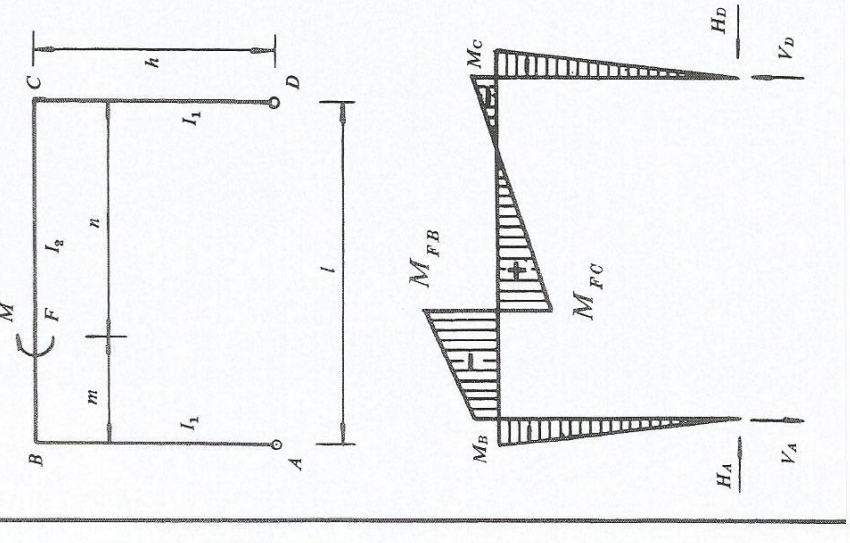
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = P$ $H_A = H_D = \frac{Pm - M_B}{h}$ Momentos flectores: $M_B = M_C = Pm\frac{(3a^2 - h^2)k}{Nh^2}$ $M_{PA} = -\frac{Pm - M_B}{h}a$ $M_{PB} = Pm - \frac{Pm - M_B}{h}a$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

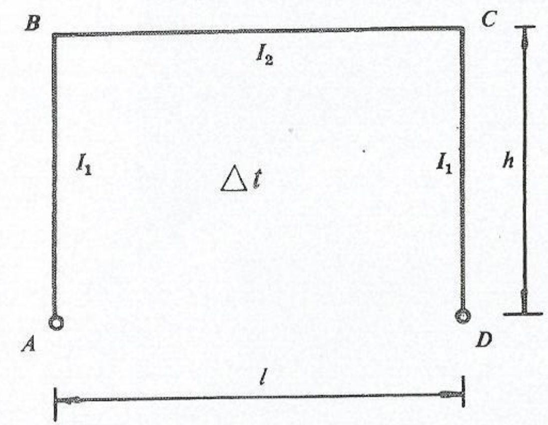


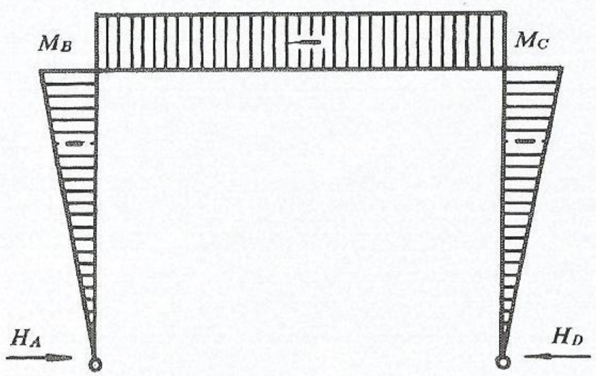
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{M}{l}$ $H_A = H_D = \frac{3M(n-m)}{2Nlh}$ Momentos flectores: $M_B = M_C = -\frac{3M(n-m)}{2Nl}$ $M_{FB} = -\frac{3M(n-m)}{2Nl} - \frac{mM}{l}$ $M_{FC} = -\frac{3M(n-m)}{2Nl} + \frac{nM}{l}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL HORIZONTAL

Aumento uniforme de temperatura





E = módulo de elasticidad

α = coeficiente de dilatación térmica

Δt = variación de la temperatura en grados

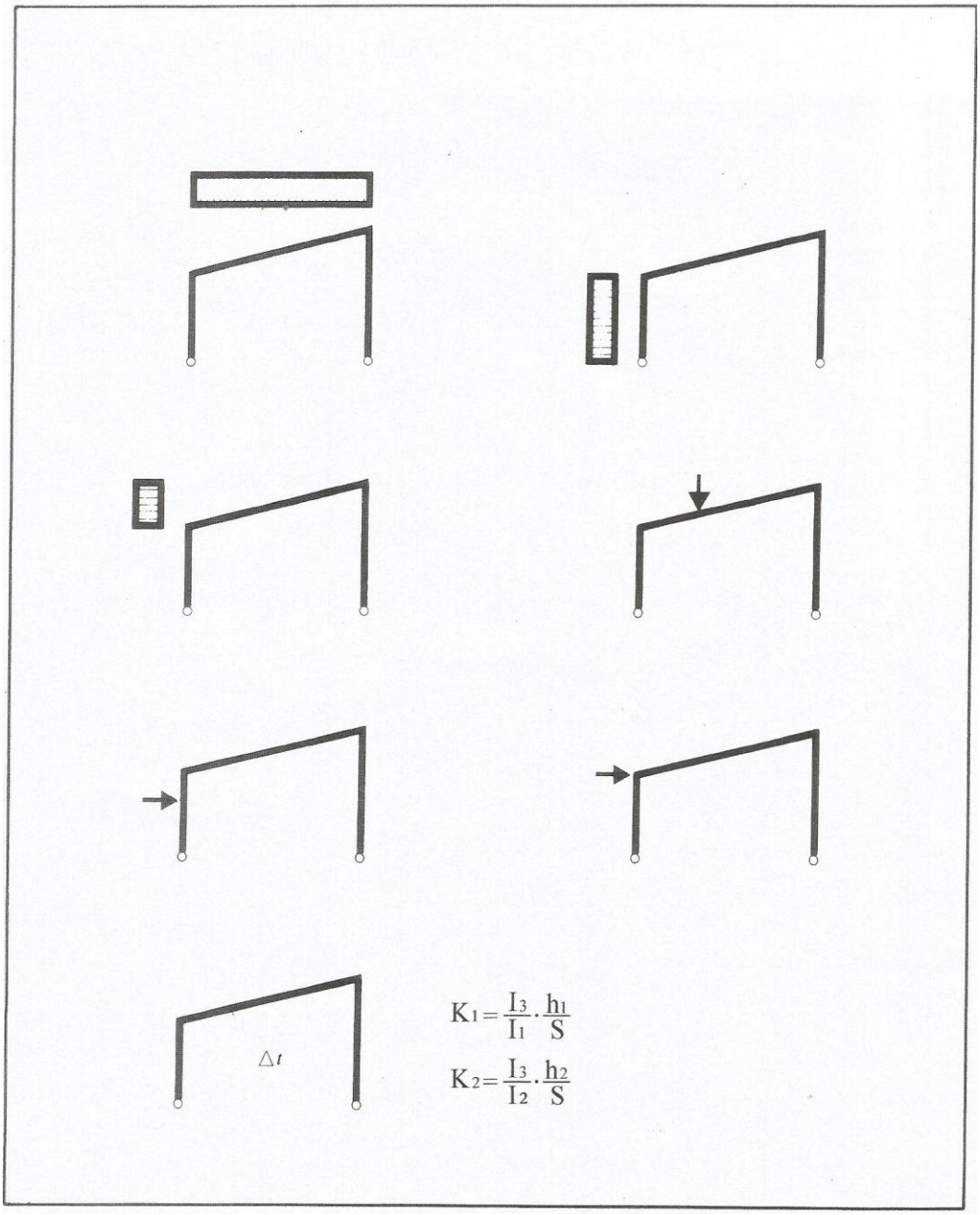
Reacciones:

$$H_A = H_D = \frac{3EI_2\alpha\,\Delta t}{h^2N}$$

Momentos flectores:

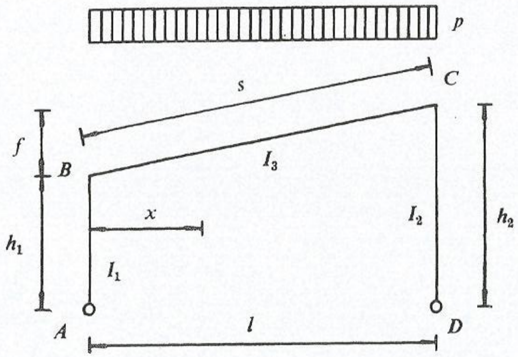
$$M_B = M_C = -\frac{3EI_2\alpha\,\Delta t}{hN}$$

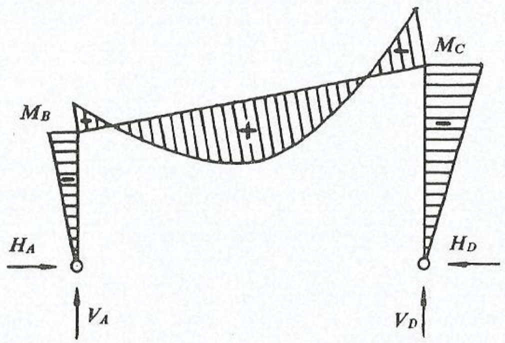
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO



PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO

Esquemas	Reacciones y solicitaciones





Reacciones:

$$V_A = V_D = \frac{pl}{2}$$

$$H_A = H_D = \frac{pl^2}{8}\,\frac{h_1 + h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

Momentos flectores:

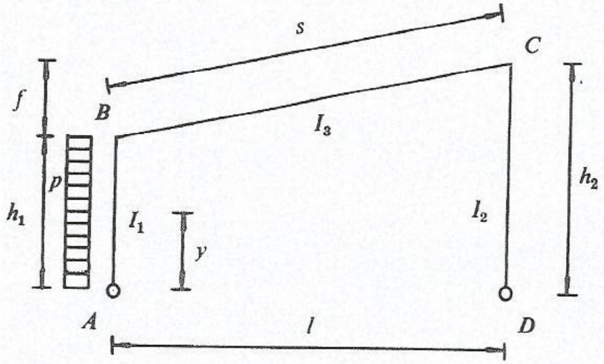
$$M_B = -\frac{pl^2}{8}\,\frac{(h_1 + h_2)h_1}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

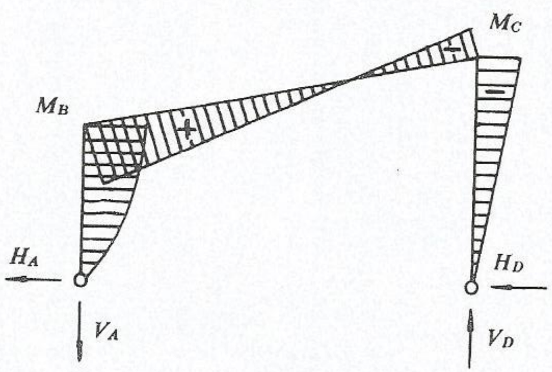
$$M_C = -\frac{pl^2}{8}\,\frac{(h_1 + h_2)h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

En BC

$$M_x = \frac{px(l - x)}{2} - H_A\,\frac{f}{l}\,x$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO





Reacciones:

$$V_A = V_D = \frac{ph_1^2}{2l}$$

$$H_A = ph_1 - H_D$$

$$H_D = \frac{ph_1^2}{8} \frac{h_1(4 + 5k_1) + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

Momentos flectores:

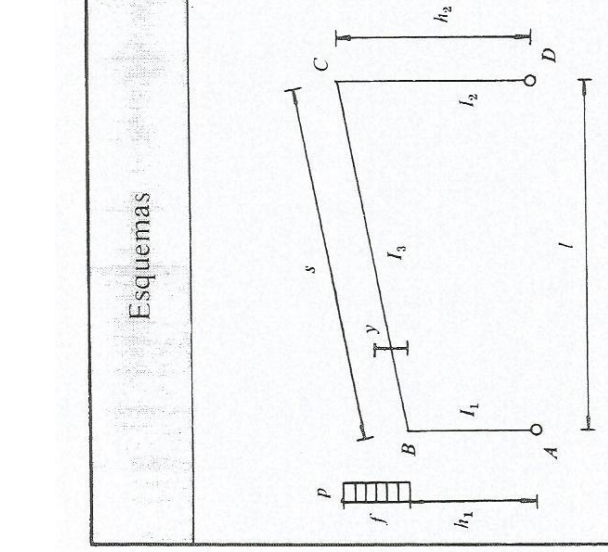
$$M_B = \frac{ph_1^2}{2} - \frac{ph_1^3}{8} \frac{h_1(4 + 5k_1) + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_C = \frac{ph_1^2h_2}{8} \frac{h_1(4 + 5k_1) + 2h_2}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

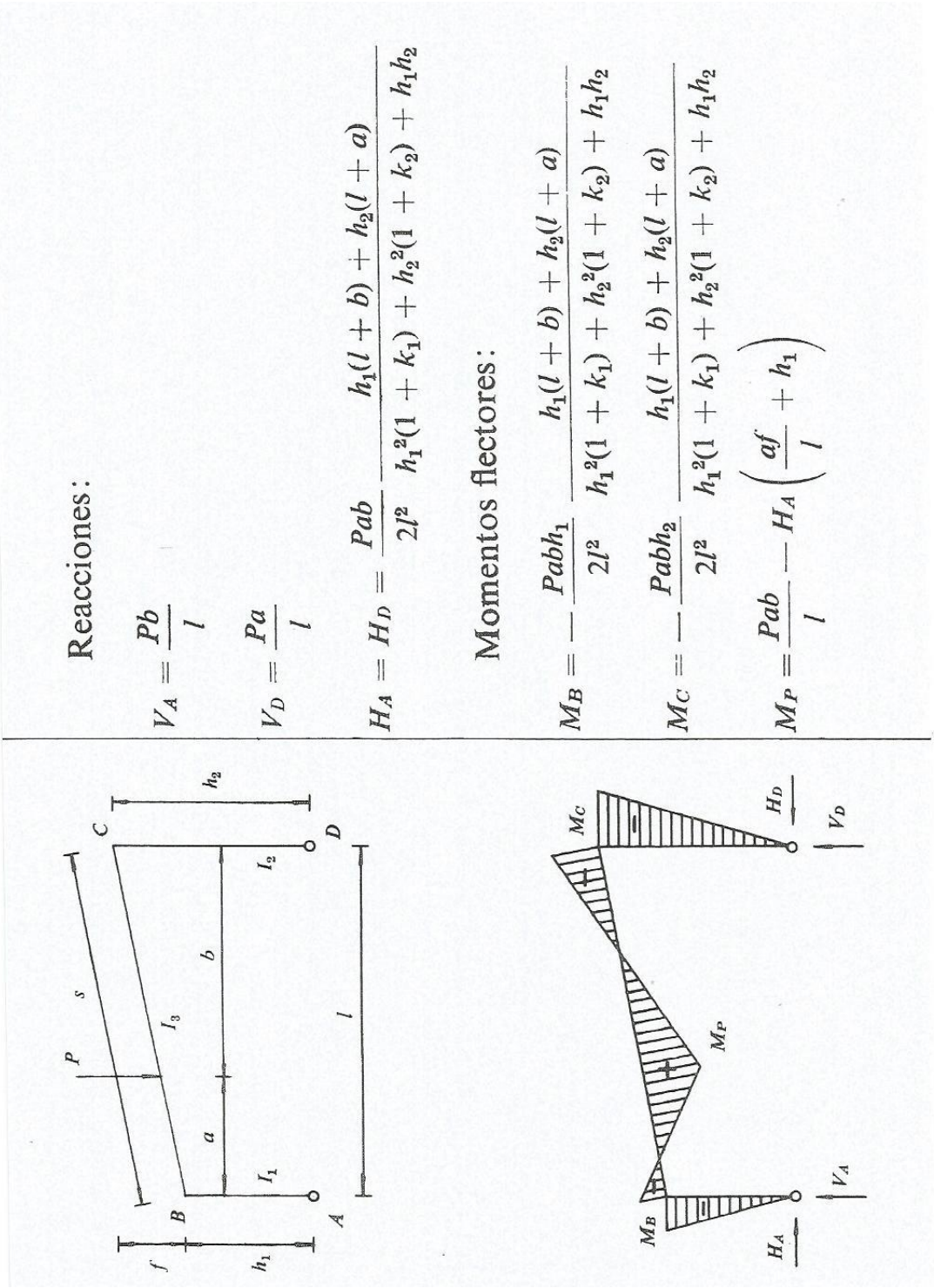
En AB

$$M_y = H_A \cdot y - \frac{py^2}{2}$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO

Esquemas	Reacciones y solicitaciones
	Reacciones:
	$V_A = V_D = \frac{pf(h_1 + h_2)}{2l}$
	$H_A = pf - H_D$
	$H_D = \frac{pf}{8} \frac{8h_1^2(1 + k_1) + 4h_1h_2 + f(h_1 + h_2)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$
	Momentos flectores:
	$M_B = pfh_1 - \frac{pfh_1}{8} \frac{8h_1^2(1 + k_1) + 4h_1h_2 + f(h_1 + h_2)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$
	$M_C = -\frac{pfh_2}{8} \frac{8h_1^2(1 + k_1) + 4h_1h_2 + f(h_1 + h_2)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$
	En BC
	$M_y = -V_i \frac{l}{f} y + H_A(y + h_1) - \frac{py^2}{2}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO



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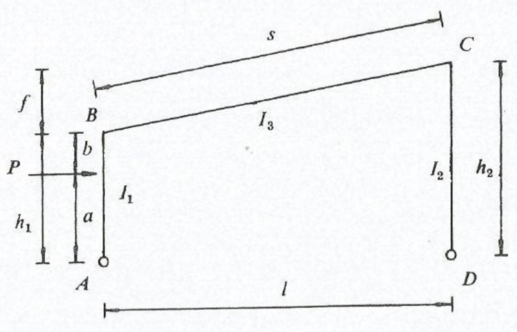
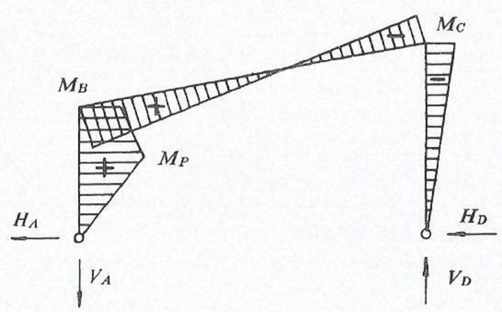
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO

Esquemas	Reacciones y solicitaciones





Reacciones:

$$V_A = V_D = \frac{Pa}{l}$$

$$H_A = P - H_D$$

$$H_D = \frac{Pa}{2h_1} \cdot \frac{2h_1^2(1 + k_1) + h_2h_1 + bk_1(h_1 + a)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

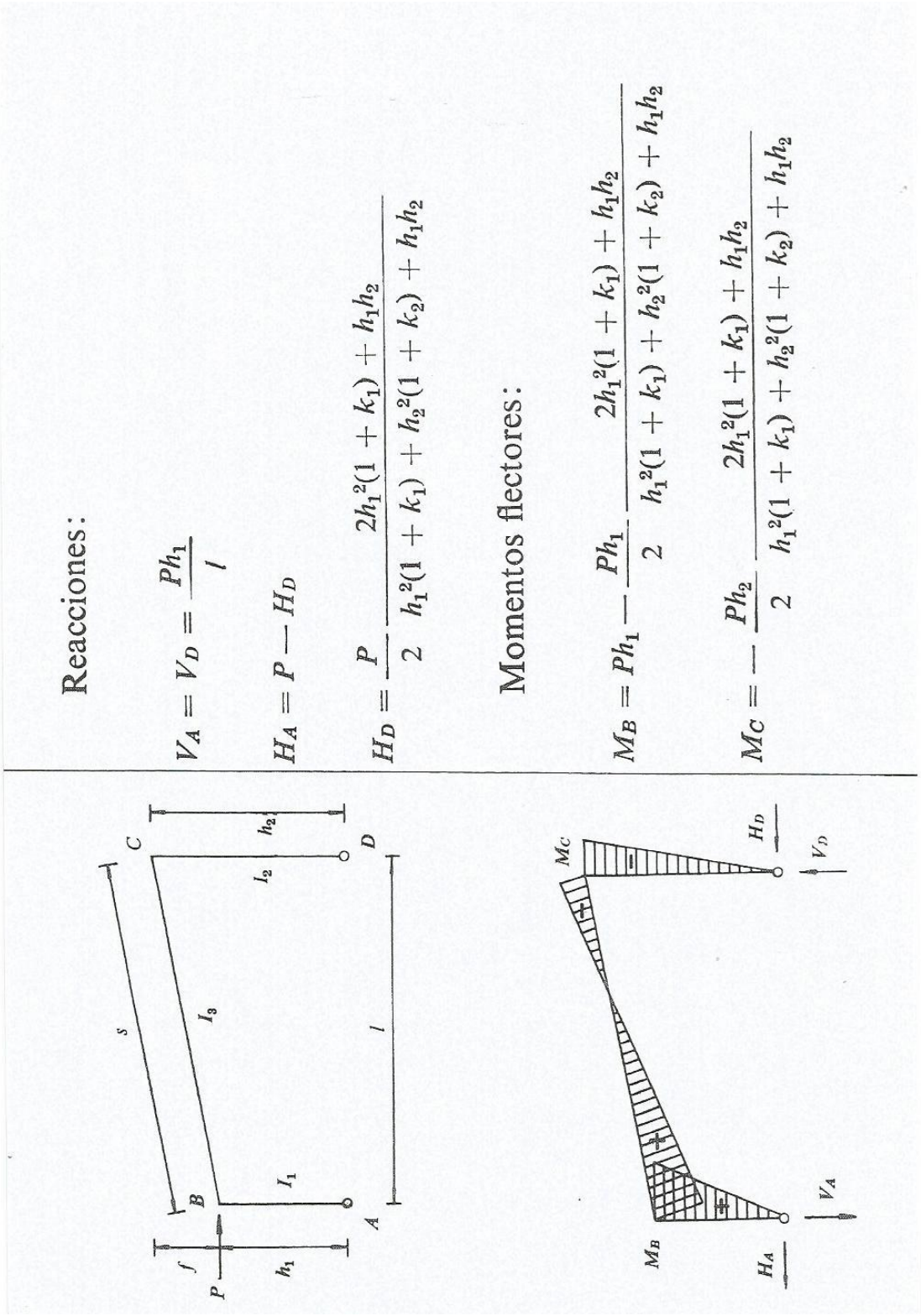
Momentos flectores:

$$M_B = Pa - \frac{Pa}{2} \cdot \frac{2h_1^2(1 + k_1) + h_2h_1 + bk_1(h_1 + a)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

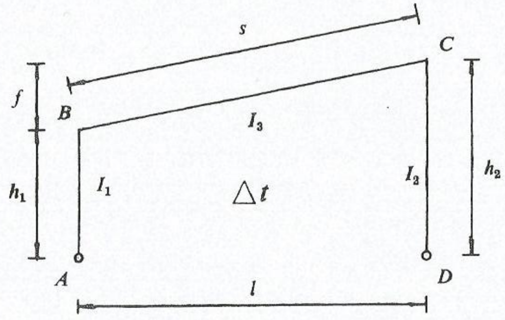
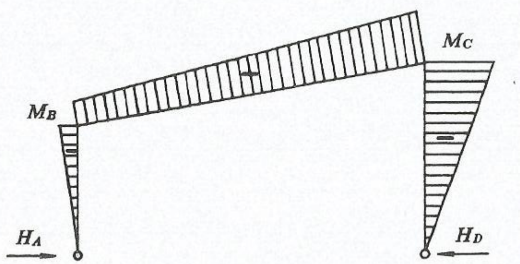
$$M_C = -\frac{Pah_2}{2h_1} \cdot \frac{2h_1^2(1 + k_1) + h_2h_1 + bk_1(h_1 + a)}{h_1^2(1 + k_1) + h_2^2(1 + k_2) + h_1h_2}$$

$$M_P = H_A \cdot a$$

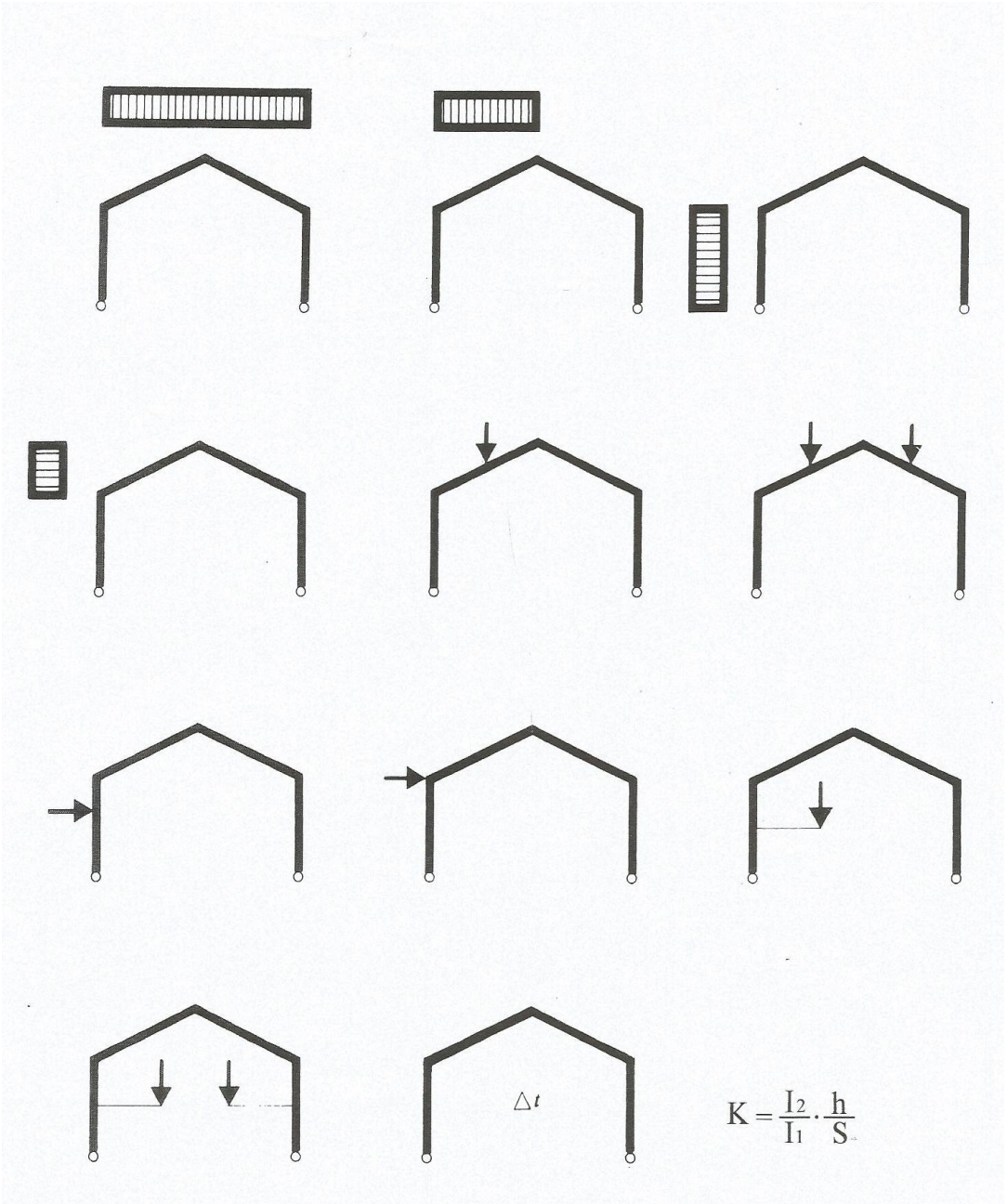
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO



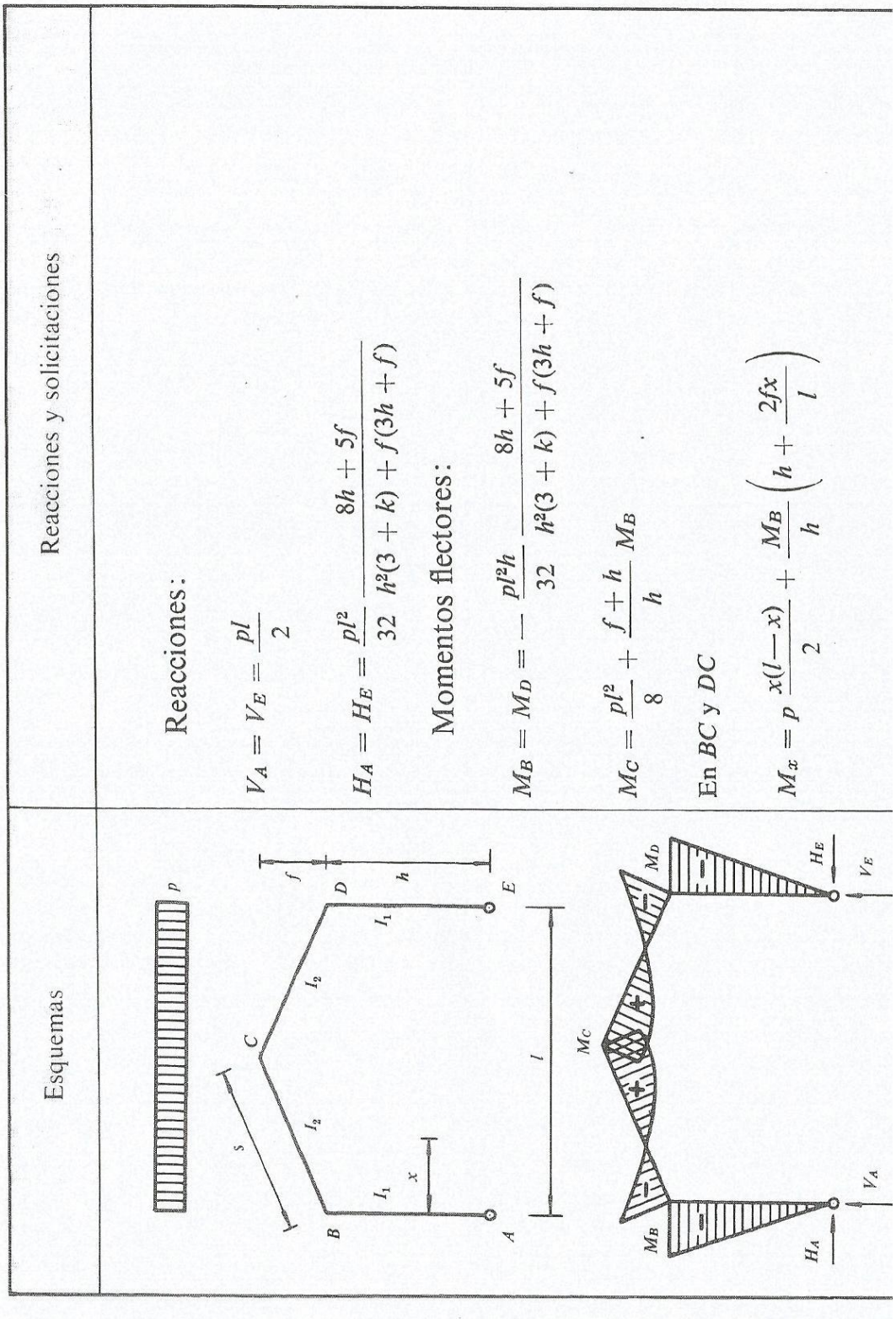
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL INCLINADO

Esquemas	Reacciones y solicitaciones
Aumento uniforme de temperatura  	E = módulo de elasticidad α = coeficiente de dilatación térmica Δt = variación de la temperatura en grados Reacciones: $H_A = H_D = \frac{3EI_3 \alpha \Delta t\, l}{s} \frac{1}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$
 	Momentos flectores: $M_B = -\frac{3EI_3 \alpha \Delta t\, l h_1}{s} \frac{1}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$ $M_C = -\frac{3EI_3 \alpha \Delta t\, l h_2}{s} \frac{1}{h_1^2(1+k_1) + h_2^2(1+k_2) + h_1 h_2}$

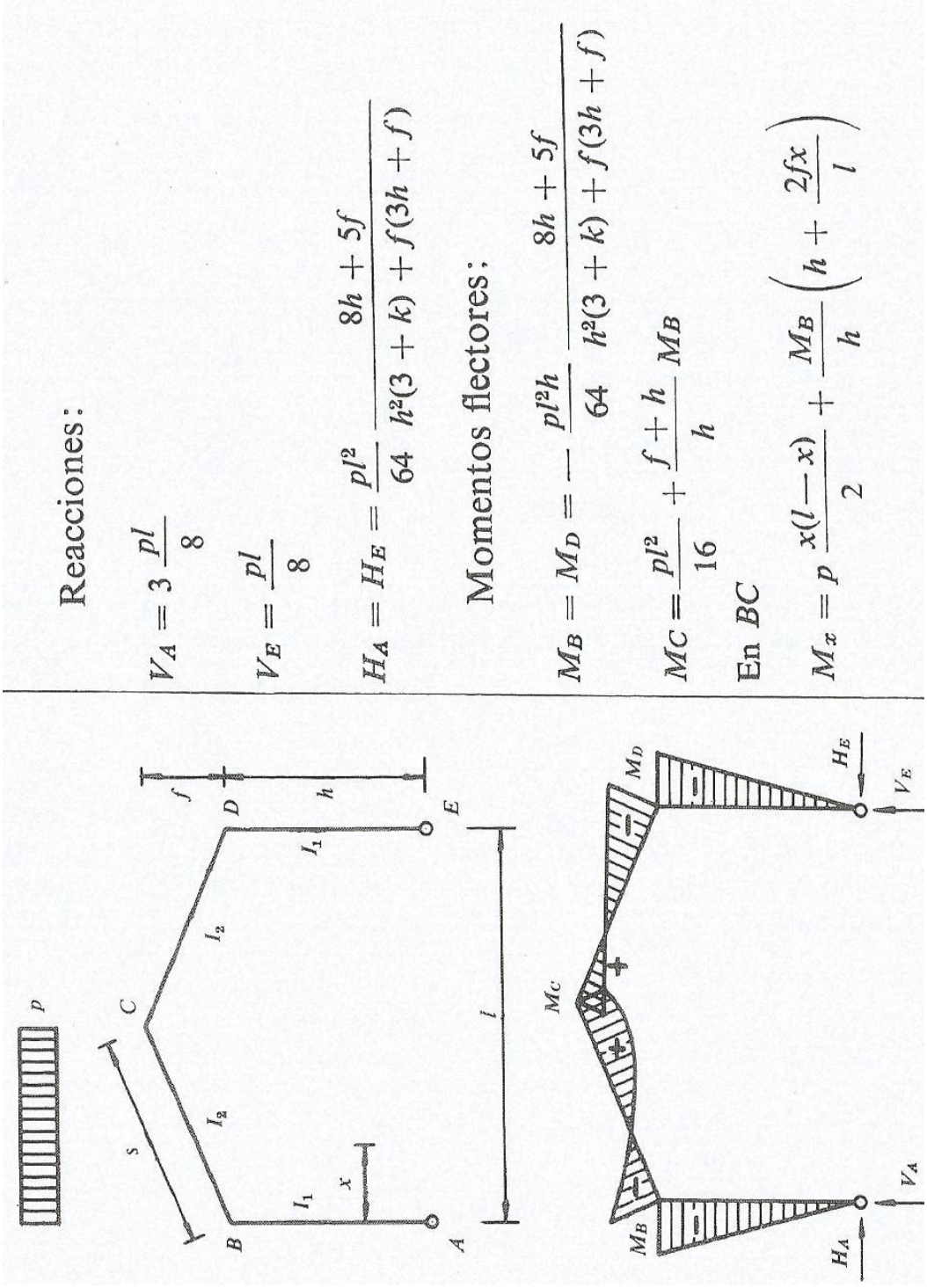
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS



PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_E = \frac{pl}{2}$ $H_A = H_E = \frac{pl^2}{32} \frac{8h + 5f}{h^2(3 + k) + f(3h + f)}$ Momentos flectores: $M_B = M_D = -\frac{pl^2h}{32} \frac{8h + 5f}{h^2(3 + k) + f(3h + f)}$ $M_C = \frac{pl^2}{8} + \frac{f + h}{h} M_B$ En *BC* y *DC* $M_x = p \frac{x(l - x)}{2} + \frac{M_B}{h} \left(h + \frac{2fx}{l} \right)$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS



Reacciones:

$$V_A = 3\,\frac{pl}{8}$$

$$V_E = \frac{pl}{8}$$

$$H_A = H_E = \frac{pl^2}{64}\,\frac{8h + 5f}{h^2(3 + k) + f(3h + f)}$$

Momentos flectores:

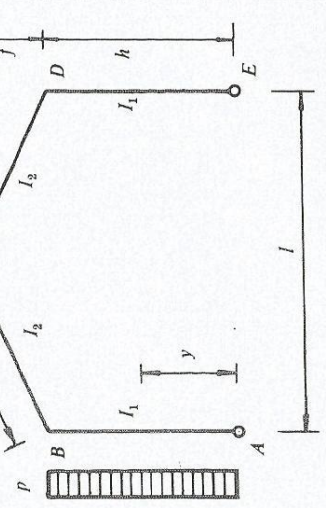
$$M_B = M_D = -\,\frac{pl^2h}{64}\,\frac{8h + 5f}{h^2(3 + k) + f(3h + f)}$$

$$M_C = \frac{pl^2}{16} + \frac{f + h}{h}\,M_B$$

En BC

$$M_x = p\,\frac{x(l - x)}{2} + \frac{M_B}{h}\left(h + \frac{2fx}{l}\right)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_E = \frac{ph^2}{2l}$ $H_A = ph - H_E$ $H_E = \frac{ph^2}{16}\,\frac{(5k+12)h+6f}{h^2(k+3)+f(f+3h)}$ Momentos flectores: $M_B = \frac{ph^2}{2} + M_D$ $M_C = \frac{ph^2}{4} + \frac{f+h}{h}\,M_D$ $M_D = -\frac{ph^3}{16}\,\frac{(5k+12)h+6f}{h^2(k+3)+f(f+3h)}$ En AB $M_y = -\frac{py^2}{2} + H_A \cdot y$

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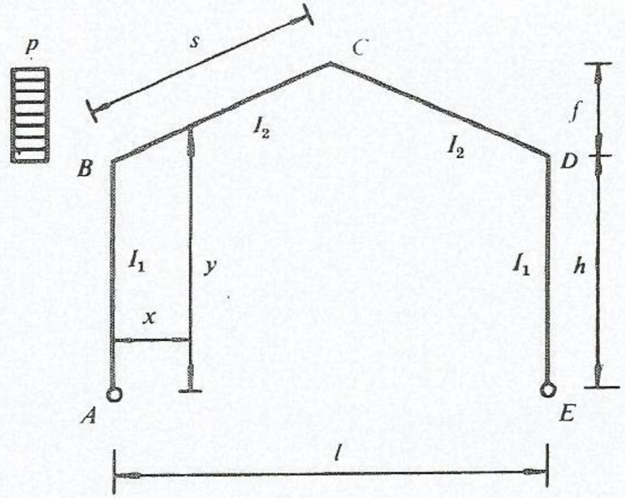
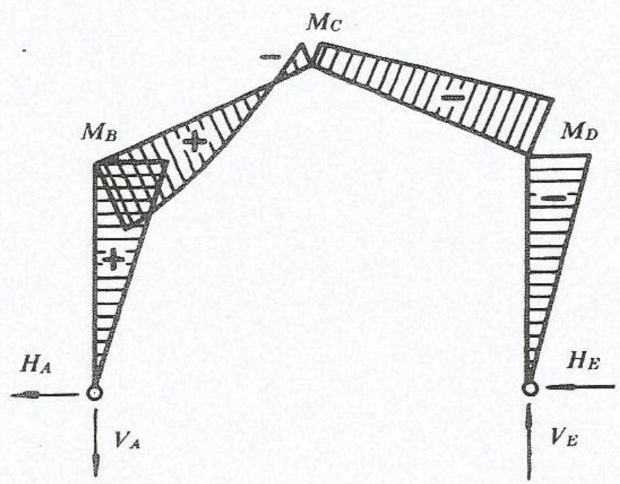
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS





Reacciones:

$$V_A = V_E = \frac{pf}{2l}(f + 2h)$$

$$H_A = pf - H_E$$

$$H_E = \frac{pf}{16} \; \frac{8h^2(k+3) + 5f(f+4h)}{h^2(k+3) + f(f+3h)}$$

Momentos flectores:

$$M_B = -H_A \cdot h$$

$$M_C = -\frac{pf^2}{16} \; \frac{4h^2(k+2) + f(5h+f)}{h^2(k+3) + f(f+3h)}$$

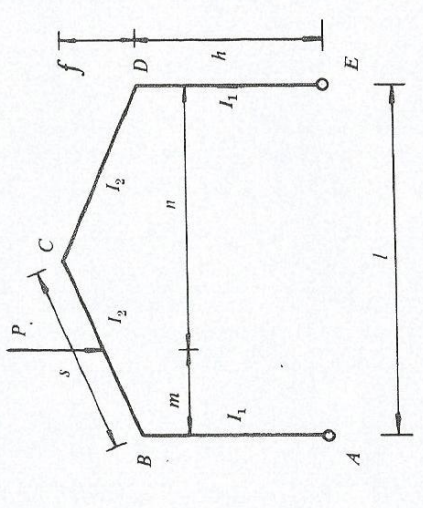
$$M_D = -H_E \cdot h$$

En BC

$$M_x = H_A \cdot y - V_A \cdot x - p\,\frac{(y-h)^2}{2}$$

siendo $y = \frac{f}{l}x + h$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = \frac{Pn}{l}$ $V_E = \frac{Pm}{l}$ $H_A = H_E = \frac{Pnl}{4l^2} \frac{6hln + f(3l^2 - 4m^2)}{h^2(k+3) + f(f+3h)}$ Momentos flectores: $M_B = M_D = -H_A \cdot h$ $M_C = \frac{Pnl}{2} + \frac{h+f}{h} M_B$ $M_P = V_A \cdot m - H_A \frac{hl + 2fm}{l}$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Reacciones:

$$V_A = V_E = P$$

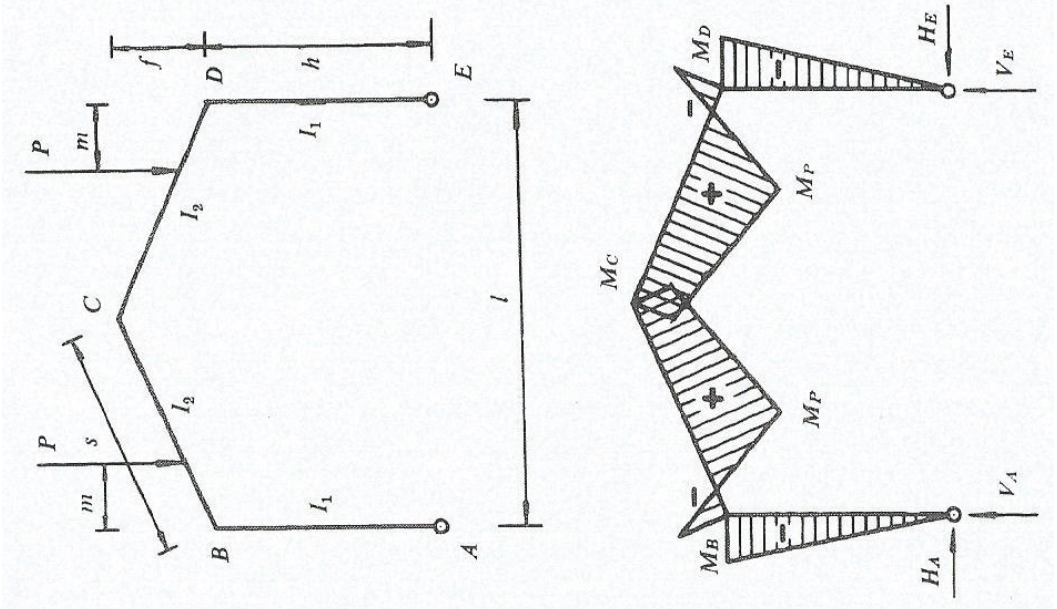
$$H_A = H_E = \frac{Pm}{2l^2} \cdot \frac{6hl(l-m) + f(3l^2 - 4m^2)}{h^2(k+3) + f(f+3h)}$$

Momentos flectores:

$$M_B = M_D = -H_A \cdot h$$

$$M_C = P\,m + \frac{h+f}{h} M_B$$

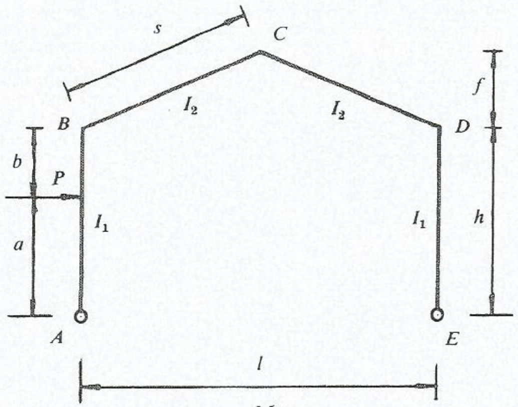
$$M_P = V_A \cdot m - H_A \frac{hl + 2fm}{l}$$

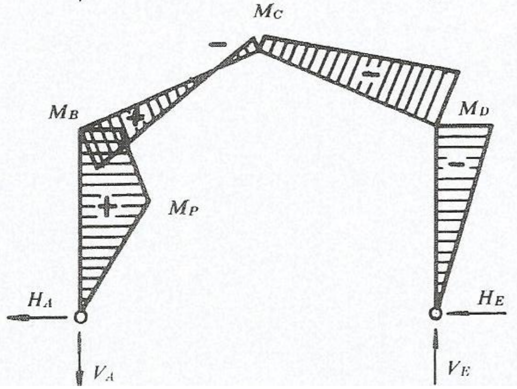


PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones

Esquemas





Reacciones y solicitaciones

Reacciones:

$$V_A = V_E = \frac{Pa}{l}$$

$$H_A = P - H_E$$

$$H_E = \frac{Pa}{4h} \, \frac{k(3h^2 - a^2) + 3h(2h + f)}{h^2(k + 3) + f(f + 3h)}$$

Momentos flectores:

$$M_B = Pa - H_E \cdot h$$

$$M_C = \frac{Pa}{2} - H_E(h + f)$$

$$M_D = - H_E \cdot h$$

$$M_P = H_A \cdot a$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Reacciones:

$$V_A = V_E = \frac{Ph}{l}$$

$$H_A = P - H_E$$

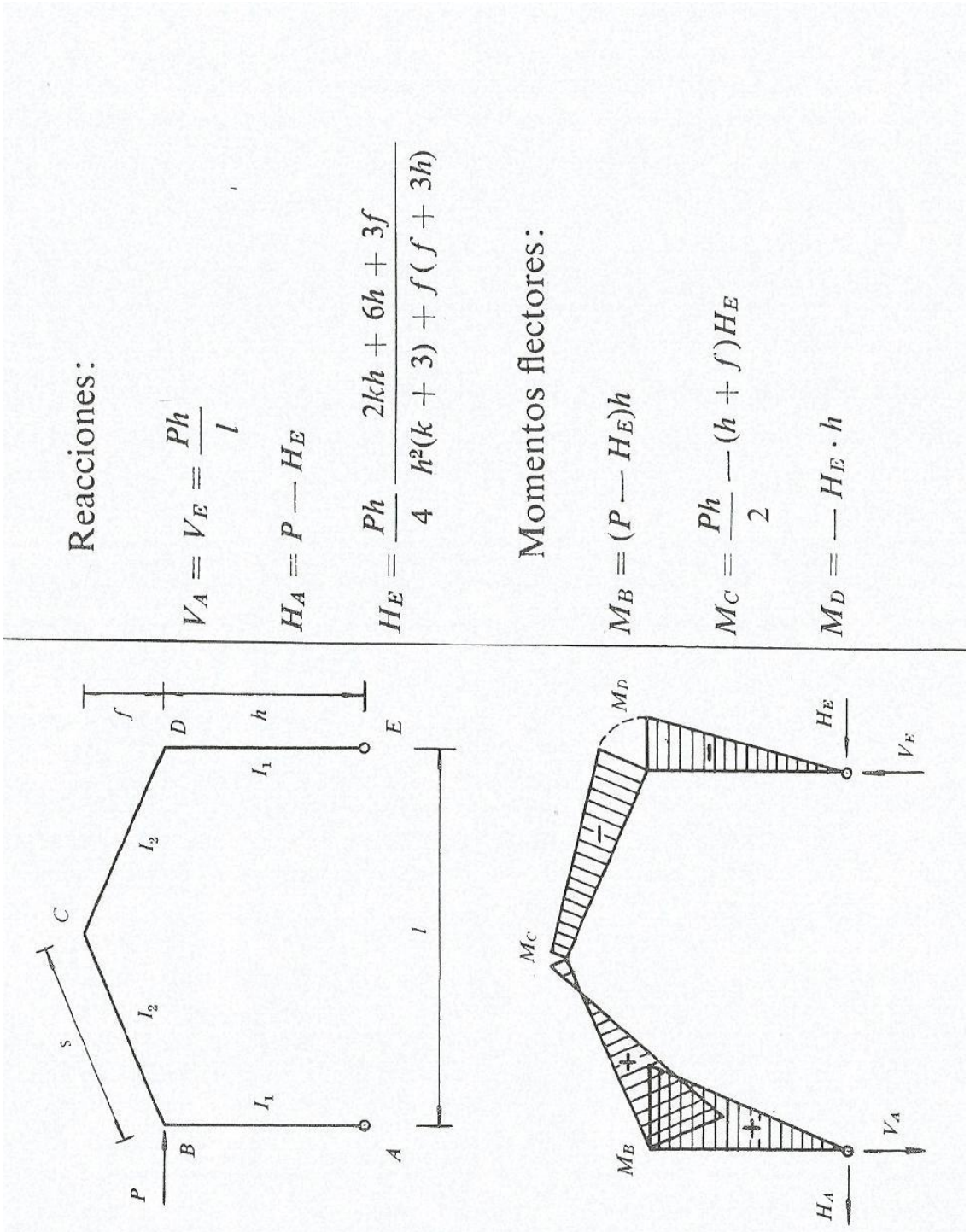
$$H_E = \frac{Ph}{4} \frac{2kh + 6h + 3f}{h^2(k+3) + f(f+3h)}$$

Momentos flectores:

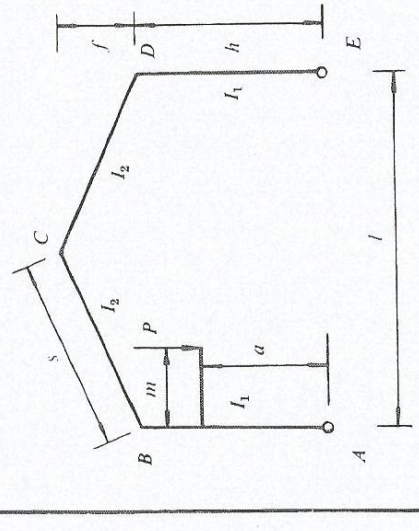
$$M_B = (P - H_E)h$$

$$M_C = \frac{Ph}{2} - (h+f)H_E$$

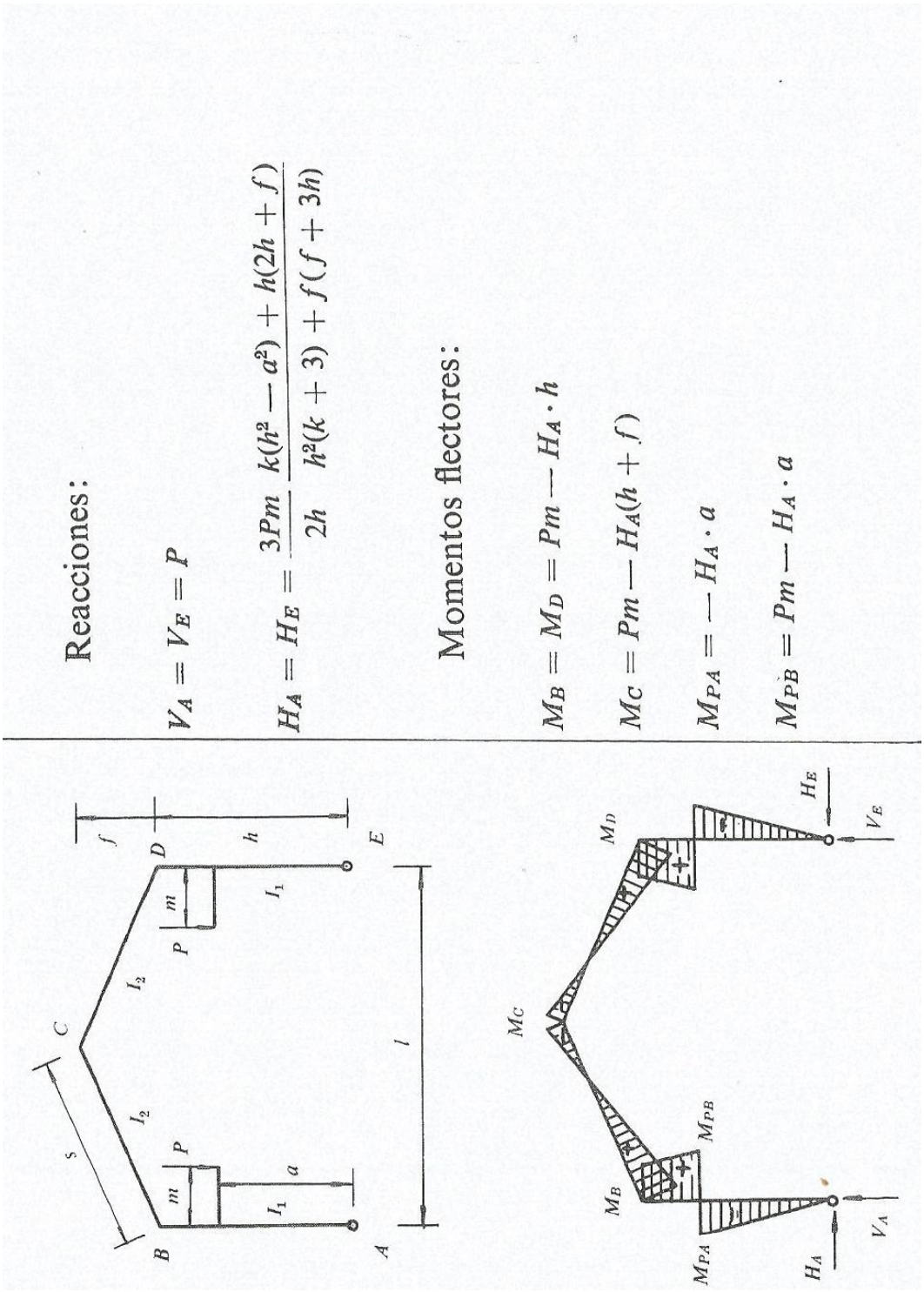
$$M_D = -H_E \cdot h$$



PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = P\,\frac{l-m}{l}$ $V_E = \frac{Pm}{l}$ $H_A = H_E = \frac{3Pm}{4h}\,\frac{k(h^2-a^2)+h(2h+f)}{h^2(k+3)+f(f+3h)}$ Momentos flectores: $M_B = Pm - H_A \cdot h$ $M_C = \frac{Pm}{2} - (f+h)H_A$ $M_D = -H_E \cdot h$ $M_{PA} = -H_A \cdot a$ $M_{PB} = Pm - H_A \cdot a$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS



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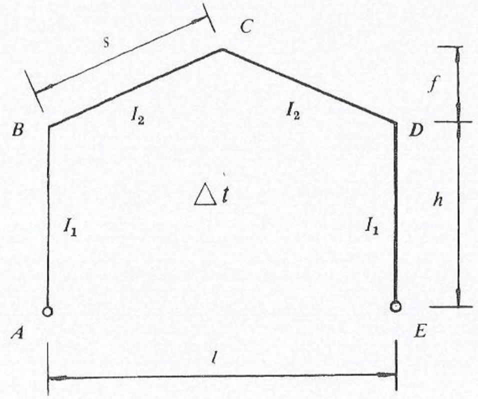
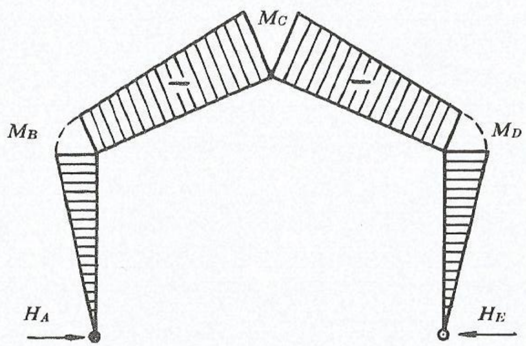
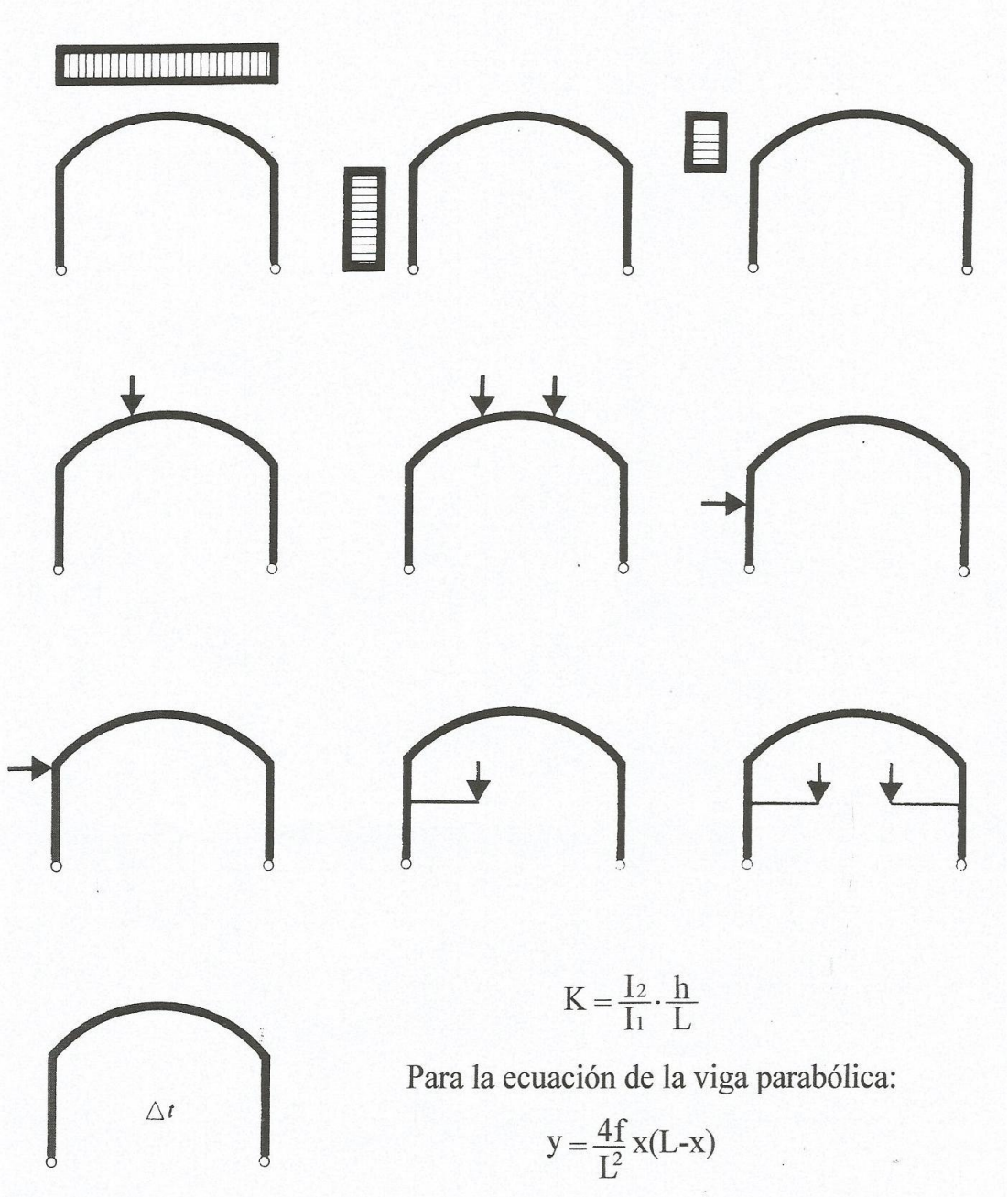
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL A DOS AGUAS

Esquemas	Reacciones y solicitaciones
Aumento uniforme de temperatura  	E = módulo de elasticidad α = coeficiente de dilatación térmica Δt = variación de la temperatura en grados Reacciones: $H_A = H_E = \dfrac{3EI_2 \alpha \, \Delta t \, l}{s[h^2(k+3) + f(f+3h)]}$ Momentos flectores: $M_B = M_D = - H_A \cdot h$ $M_C = - H_A(h+f)$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

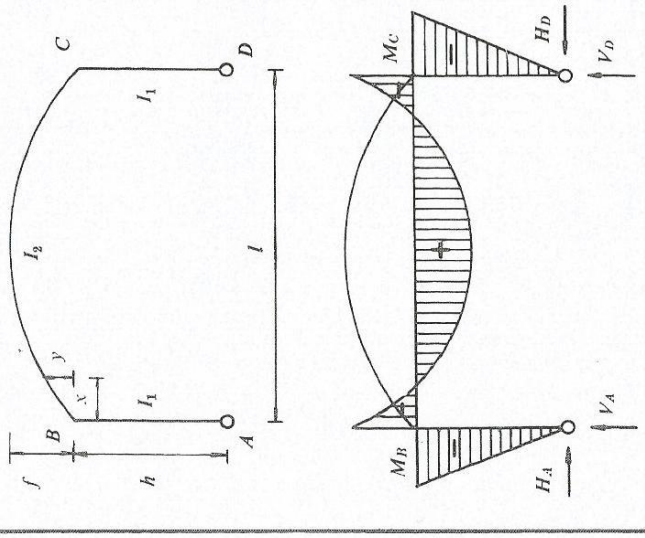


$$K = \frac{I_2}{I_1} \cdot \frac{h}{L}$$

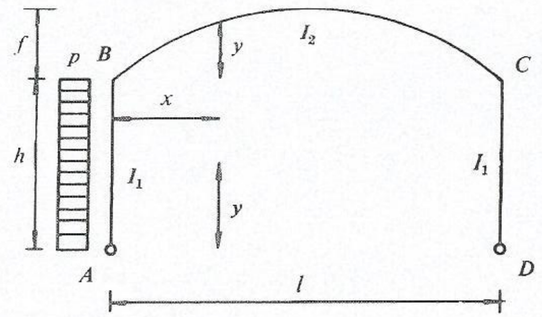
Para la ecuación de la viga parabólica:

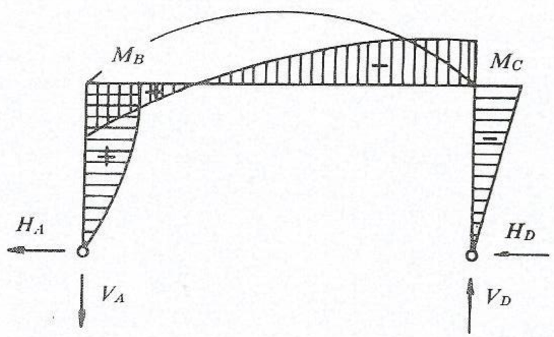
$$y = \frac{4f}{L^2} x(L-x)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Esquemas	Reacciones y solicitaciones
	Reacciones: $V_A = V_D = \frac{pl}{2}$ $H_A = H_D = \frac{pl^2}{4} \frac{5h + 4f}{5h^2(2k + 3) + 4f(5h + 2f)}$ Momentos flectores: $M_B = M_C = \frac{pl^2 h}{4} \frac{5h + 4f}{5h^2(2k + 3) + 4f(5h + 2f)}$ En BC $M_x = px \frac{l - x}{2} - H_A(h + y)$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO





Reacciones:

$$V_A = V_D = \frac{ph^2}{2l}$$

$$H_A = ph - H_D$$

$$H_D = \frac{5ph^2}{8} \frac{h(5k+6)+4f}{5h^2(2k+3)+4f(5h+2f)}$$

Momentos flectores:

$$M_B = \frac{ph^2}{2} - H_D \cdot h$$

$$M_C = -\frac{5ph^3}{8} \frac{h(5k+6)+4f}{5h^2(2k+3)+4f(5h+2f)}$$

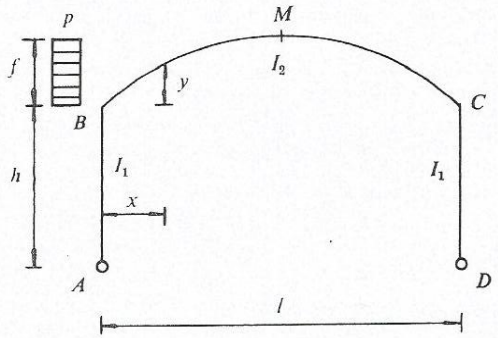
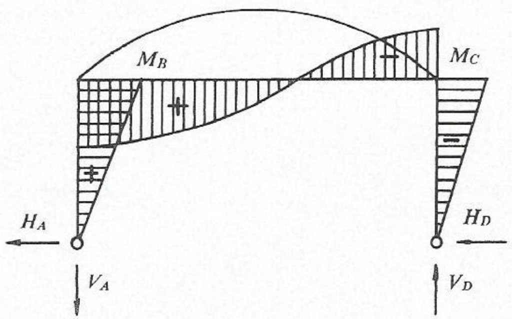
En AB

$$M_y = (ph - H_D)y - p\frac{y^2}{2}$$

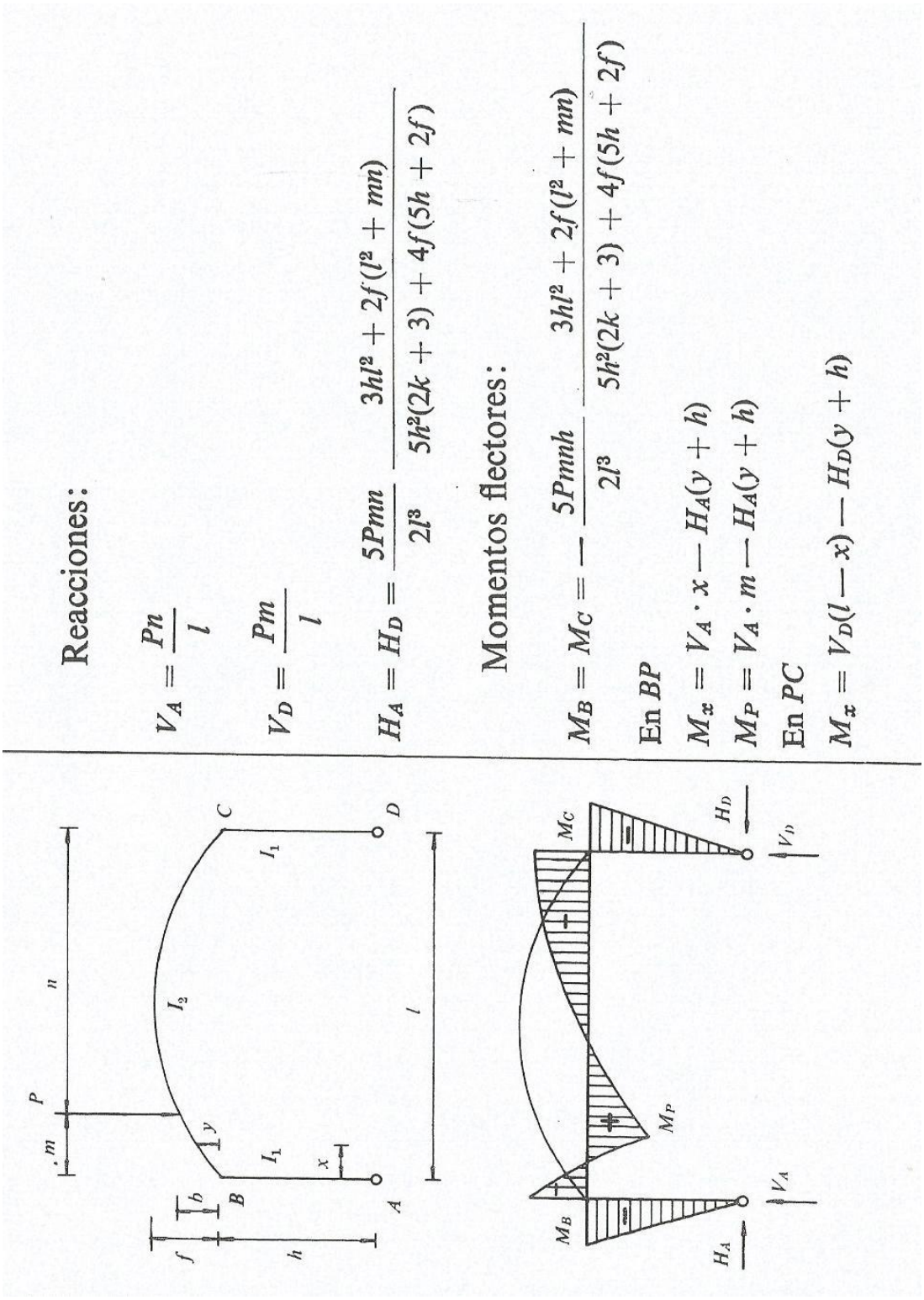
En BC

$$M_x = V_D(l-x) - H_D(h+y)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Esquemas	Reacciones y solicitaciones
 	**Reacciones:** $V_A = V_D = p\,\dfrac{f(2h+f)}{2l}$; $H_A = pf - H_D$; $H_D = \dfrac{pf}{14}\,\dfrac{35h^2(2k+3)+16f(7h+2f)}{5h^2(2k+3)+4f(5h+2f)}$ **Momentos flectores:** $M_B = (pf - H_D)h$; $M_C = -\dfrac{pf}{14}\,\dfrac{35h^2(2k+3)+16f(7h+2f)}{5h^2(2k+3)+4f(5h+2f)}$ En BM: $Mx = (pf - H_D)(h+y) - p\,\dfrac{f(2h+f)}{2l}\,x - \dfrac{py^2}{2}$ En MC: $M_x = V_D(l-x) - H_D(h+y)$

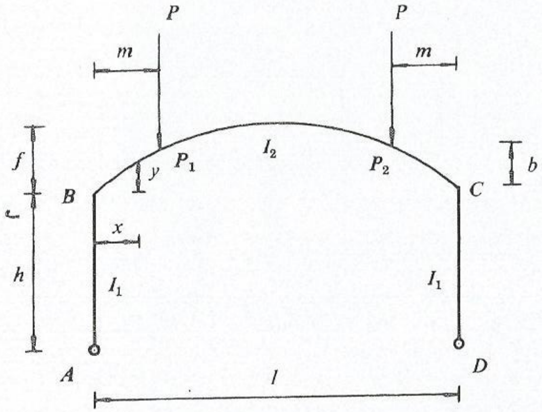
PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

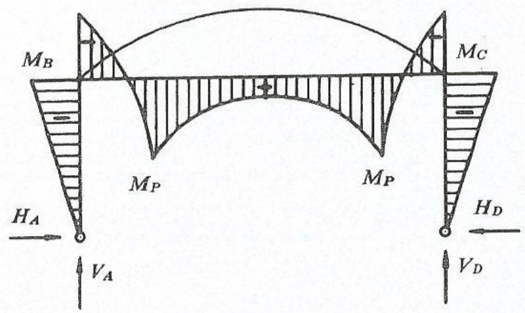


PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Esquemas	Reacciones y solicitaciones

Esquemas





Reacciones y solicitaciones

Reacciones:

$$V_A = V_D = P$$

$$H_A = H_D = \frac{5Pm\,(l - m)}{l^3}\;\frac{3hl^2 + 2f\,(l^2 + lm - m^2)}{5h^2\,(2k+3) + 4f\,(5h + 2f)}$$

Momentos flectores:

$$M_B = M_C = -\frac{5Pm\,(l - m)h}{l^3}\;\frac{3hl^2 + 2f\,(l^2 + lm - m^2)}{5h^2\,(2k+3) + 4f\,(5h + 2f)}$$

En BP_1

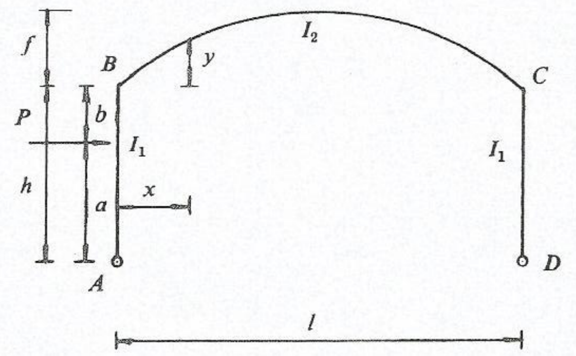
$$M_x = V_A \cdot x - H_A\,(y + h)$$

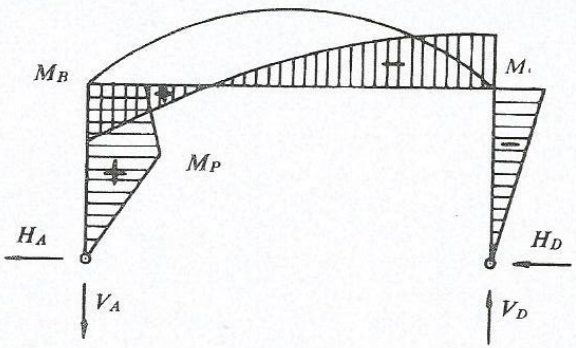
$$M_P = V_A \cdot m - H_A\,(b + h)$$

En P_1P_2

$$M_x = Pm - H_A\,(y + h)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO





Reacciones:

$$V_A = V_D = \frac{Pa}{l}$$

$$H_A = P - H_D$$

$$H_D = \frac{5pa}{2h}\,\frac{h^2(2k + 3) + h(2f + bk) + abk}{5h^2(2k + 3) + 4f(5h + 2f)}$$

Momentos flectores:

$$M_B = Pa - H_D \cdot h$$

$$M_C = -\frac{5Pa}{2}\,\frac{h^2(2k + 3) + h(2f + bk) + abk}{5h^2(2k + 3) + 4f(5h + 2f)}$$

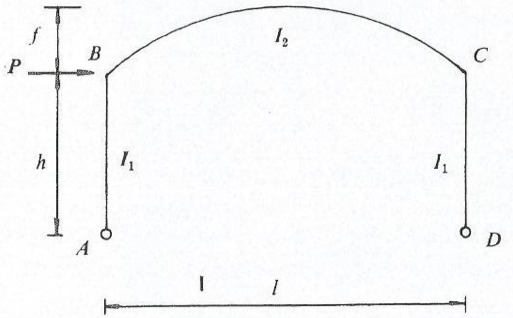
$$M_P = (P - H_D)a$$

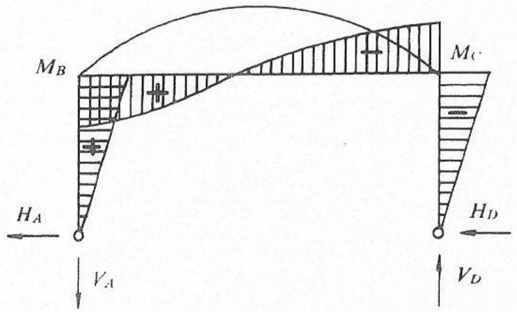
En BC

$$M_x = V_D(l - x) - H_D(h + y)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO

Esquemas	Reacciones y solicitaciones





Reacciones:

$$V_A = V_D = \frac{Ph}{l}$$

$$H_A = P - H_D$$

$$H_D = \frac{5Ph}{2} \frac{h(2k+3)+2f}{5h^2(2k+3)+4f(5h+2f)}$$

Momentos flectores:

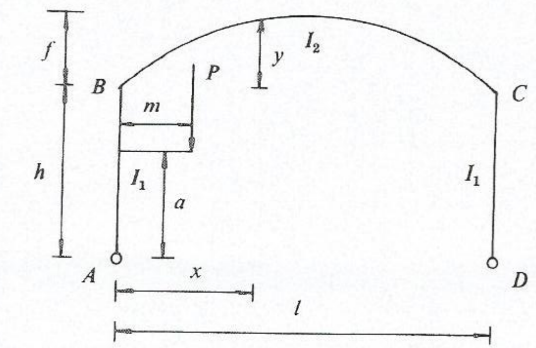
$$M_B = (P - H_D)h$$

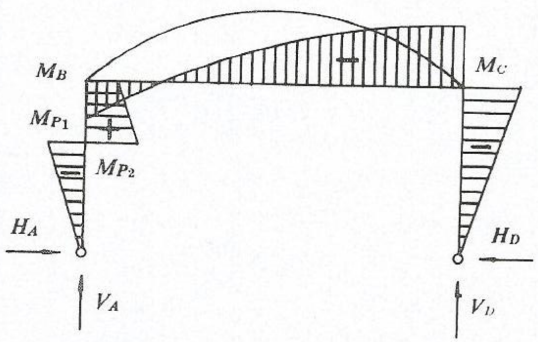
$$M_C = -\frac{5Ph^2}{2} \frac{h(2k+3)+2f}{5h^2(2k+3)+4f(5h+2f)}$$

En BC

$$M_x = V_D(l-x) - H_D(h+y)$$

PÓRTICOS SIMPLES BIARTICULADOS A LA MISMA ALTURA DINTEL CURVO





Reacciones:

$$V_A = P - \frac{Pm}{l}$$

$$V_D = \frac{Pm}{l}$$

$$H_A = H_D = \frac{5Pm}{2h} \frac{3k(h^2 - a^2) + h(2f + 3h)}{5h^2(2k + 3) + 4f(5h + 2f)}$$

Momentos flectores:

$$M_B = Pm - H_A \cdot h$$

$$M_C = - H_A \cdot h$$

$$M_{P_1} = - H_A \cdot a$$

$$M_{P_2} = Pm - H_A \cdot h$$

En BC

$$M_x = \frac{Pm}{l}(l - x) - H_A(h + y)$$