

Moment – Rotation Curve in Saddlebag Connections

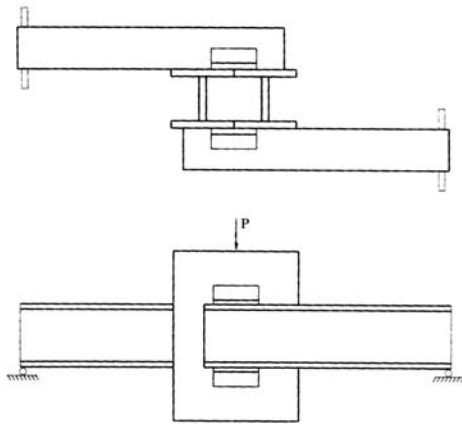
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Abstract

In this paper the most important character of saddlebag type connection which is the moment – rotation relation has been driven based on the dimensions of its constitutive angles. An analytical model with three parameters has been chosen to present the moment – rotation relationship. The two first parameters are respectively the initial stiffness and ultimate moment capacity of the connection, the third one (shape parameter) has been determined by the least square method. Finally considering the test results and mathematical equations a practical method is proposed to determine the rigidity of all saddlebag type connection.

Key words: Steel structures, Connections, Semi-rigid connections, Saddlebag type connections.



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$M-\theta$

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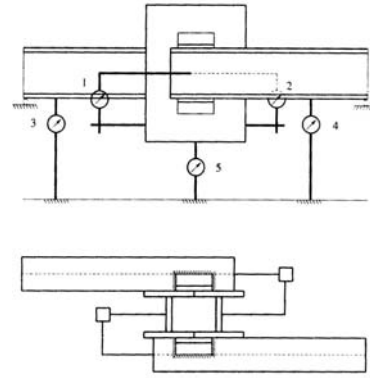
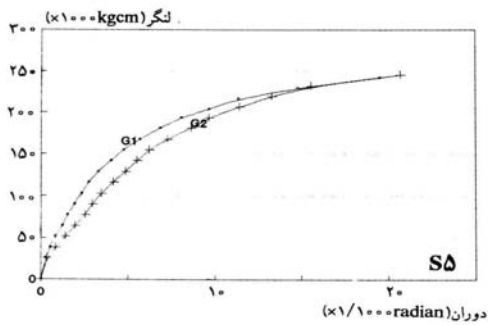
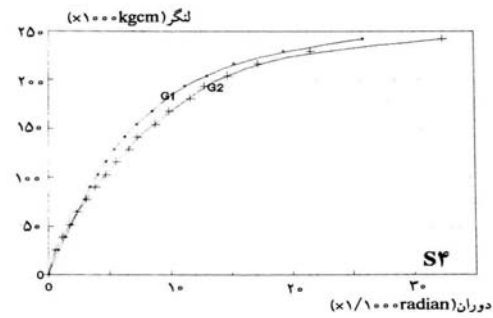
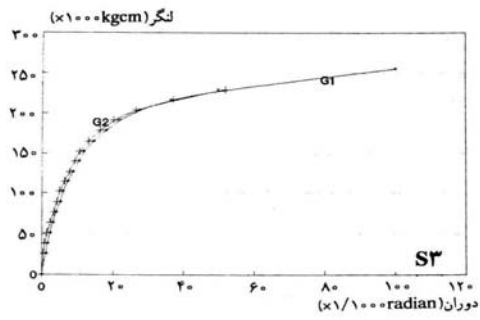
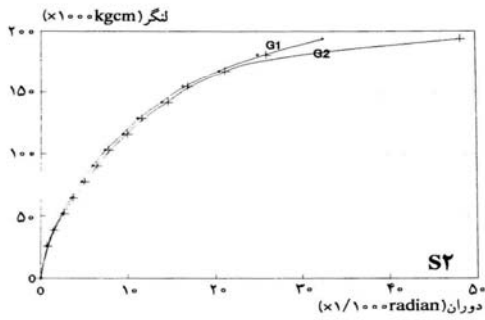
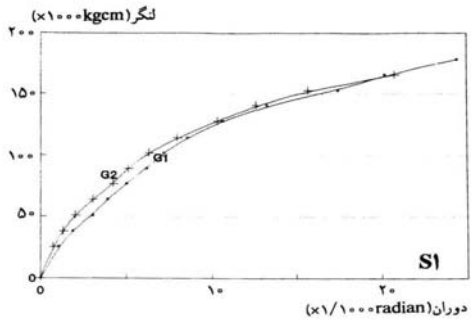
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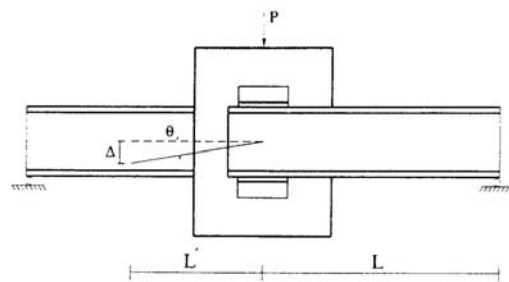
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	cm	cm		cm	
S	IPE	IPE	L * *		
S	IPE	IPE	L * *		
S	IPE	IPE	L * *		
S	IPE	IPE	L * *		
S	IPE	IPE	L * *		



(θ) ()

() ()



$$M = \frac{PL}{2} \quad ()$$

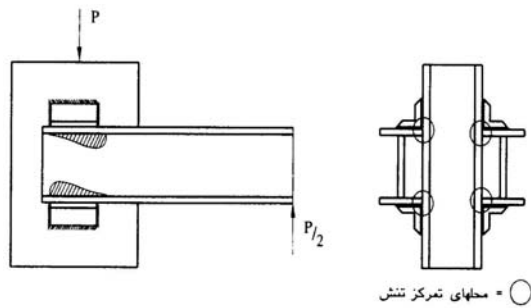
$$\theta = \frac{\Delta}{L'} \quad ()$$

() L L'

P Δ . L'

() ()

() M - θ ()

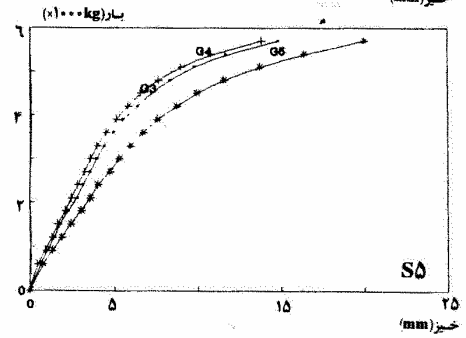
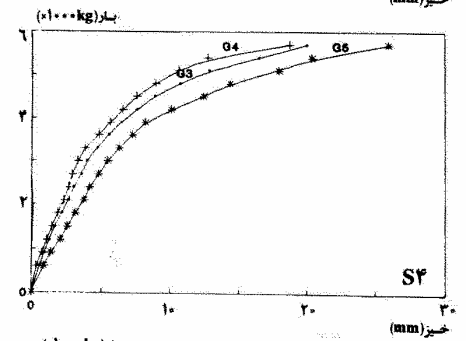
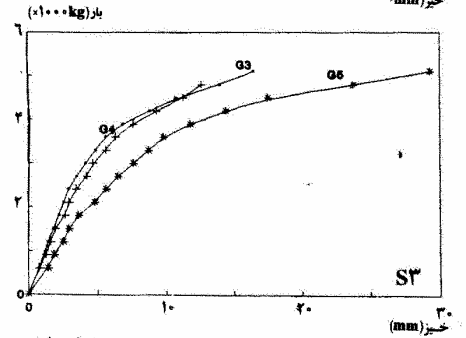
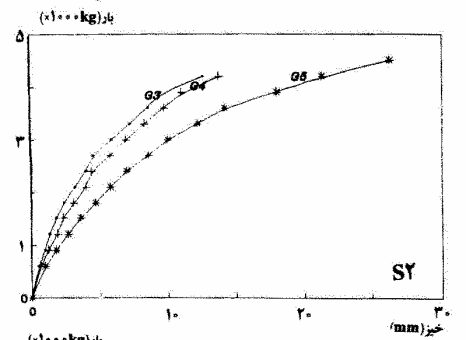
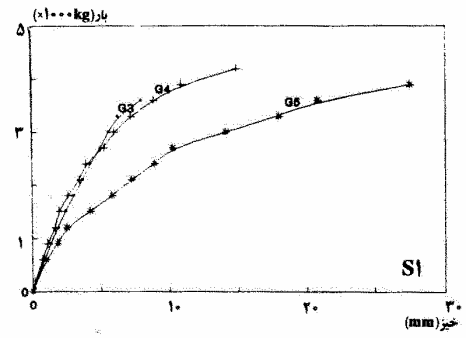


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- B (Polynommal Model)
- (Exponential (Cubic B-Spline)
- (Ang-Morris Power Model)
- (Lui-Chen Model)
- (Colson Power Exponential Model)
- (Kshi and chen Power Model)
- [] Model)

: [] ()



$$M = Ph \quad ()$$

$$M(\theta_r) = \frac{R_1 \theta_r}{\left[1 + \left(\frac{\theta_r}{\theta_0}\right)^n\right]^{1/n}} + R_{kp} \theta_r \quad ()$$

$$\frac{M}{\theta} = \frac{h^2 P}{2\Delta} \quad ()$$

$$R_{ki} \quad M = R_{ki} \theta \quad R_1 = R_{ki} - R_{kp} \quad (-)$$

$$R_{ki} = \frac{h^2 b^3 t_a}{8a'^3} \left[\frac{E}{1 + \frac{0.78b^2}{a'^2}} \right] \quad ()$$

$$\theta_0 = \frac{M_u}{R_{ki}} \quad (-)$$

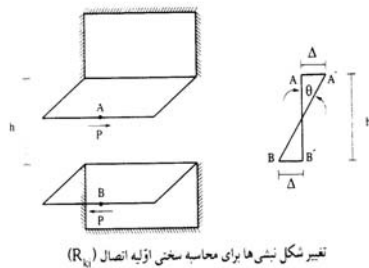
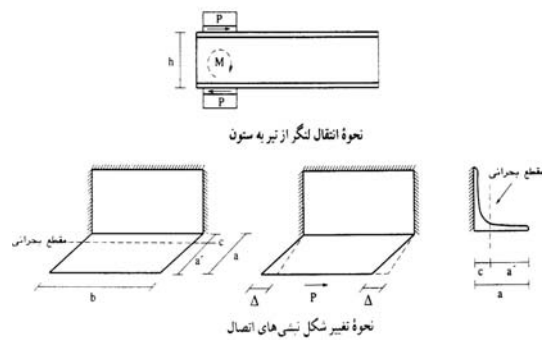
$$() \quad a' \quad b \quad h \quad t_a$$

$$() \quad : M_u$$

$$() \quad R_{kp} = 0$$

$$() \quad ()$$

$$M(\theta_r) = \frac{R_{ki} \theta_r}{\left[1 + \left(\frac{\theta_r}{\theta_0}\right)^n\right]^{1/n}} \quad ()$$



$$\Delta = \frac{Pa'^3}{3EI_a} \left[1 + \frac{0.78b^2}{a'^2} \right] \quad ([]) \quad ()$$

$$I_a = \frac{1}{12} b^3 t_a$$

$$\theta = \frac{2\Delta}{h} \quad ()$$

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$\sigma_y = 2300 \text{ kg/cm}^2 \quad E = 2.1 \times 10^6 \text{ kg/cm}^2$

	a cm	c cm	a' cm	b cm	t _a Cm	h cm	tcm/radian R _{kt}	
								()
S					/		/	/
S				/	/		/	/
S	*	/	/		/		/	/
S		/	/	/	/			
S	*	/	/	/	/		/	/

/ cm a *

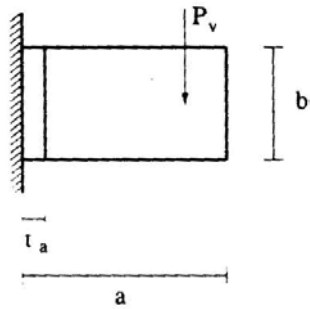
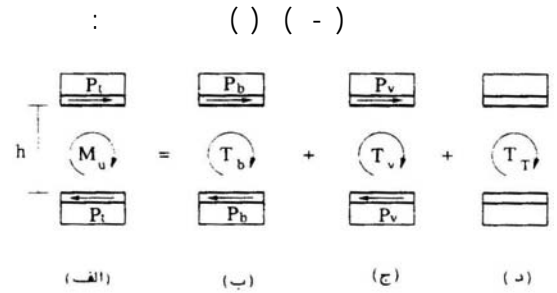
: () (-)

(T_b)

$P_v = bt\tau_y$

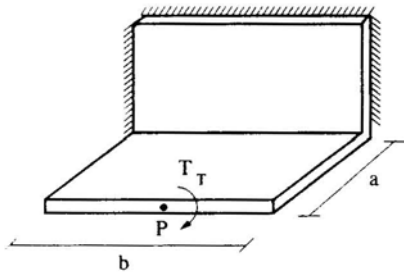
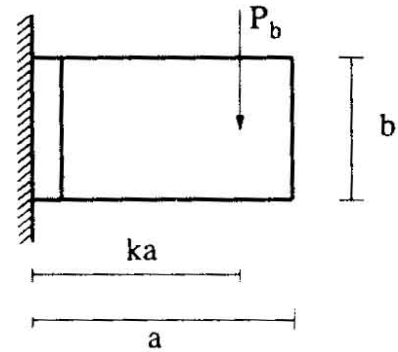
$T_v = P_v h = bth\tau_y = \frac{bth}{\sqrt{3}}\sigma_y$

()



(T_T)

: () (-)



$M_b = \frac{\sigma_y I}{C} = \frac{\sigma_y b^2 t}{6}$

$P_b = \frac{M_b}{ka}$

$T_b = P_b h = \frac{M_b}{ka} h = \frac{hb^2 t}{6ka} \sigma_y$ ()

(T_v)

$$\frac{\theta_r}{M - \theta_r} \quad ()$$

$$R(\theta_r) = \frac{dM}{d\theta_r} = \frac{R_{ki} \theta_o}{\left[1 + \left(\frac{\theta_r}{\theta_o} \right)^n \right]^{\frac{n+1}{n}}} \quad ()$$

$n \rightarrow \infty$

$$T_T = \frac{r_y J}{C} = \frac{(\sigma_y / \sqrt{3}) \frac{1}{3} bt^3}{t/2} = \frac{2\sigma_y bt^2}{3\sqrt{3}}$$

$$T_T = \frac{4\sigma_y bt^2}{3\sqrt{3}} \quad ()$$

$$M_u = T_b + T_v + T_T$$

$$M_u = \left[\frac{b^2 ht}{6ka} + \frac{bth}{\sqrt{3}} + \frac{4bt^2}{3\sqrt{3}} \right] \sigma_y \quad ()$$

$$\frac{1}{3} \quad ()$$

$\sigma_y = 2300 \text{ kg/cm}^2$

	a cm	a > b _f a = b _f	b cm	k	t Cm	h cm	M _u t.cm	
							()	
S				—	/			
S			/	—	/			
S		/		—	/			
S			/	—	/			
S		/	/	—	/			

$$E(n) = \sum_{k=1}^N \left\{ \frac{R_{ki} (\theta_r)_k}{\left[1 + \left(\frac{\theta_r}{\theta_o} \right)_k^n \right]^{1/n}} - M_k (\theta_r) \right\}^2 \quad ()$$

$$M - \theta_r$$

$$M_u \quad (-) \quad \theta_o$$

$$R_{ki}$$

$$E(x) = \sum_{k=1}^m [f(x_k) - y_k]^2 \quad ()$$

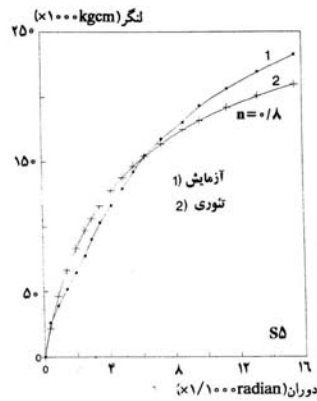
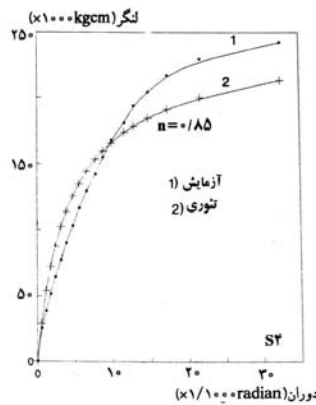
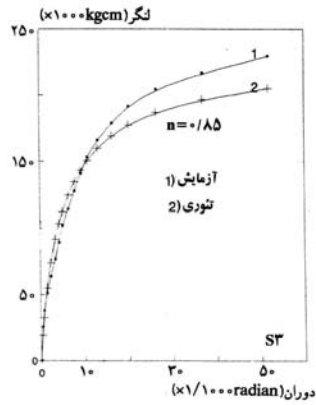
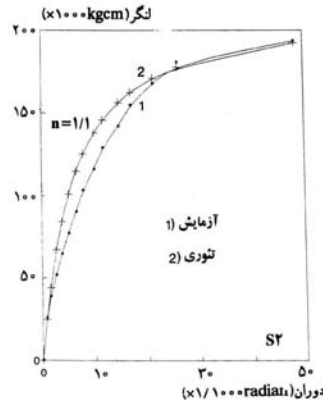
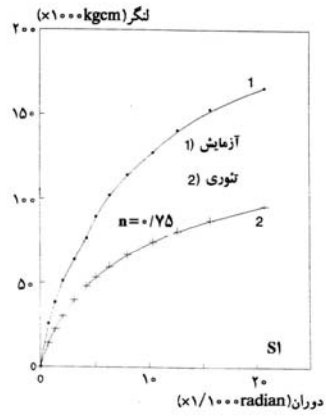
$M - \theta$ n n k $(\theta_r)_k$
() k $M_k(\theta_r)$

n

n

E(n)

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$$L = 0.3 m$$

S

$$w = 1400 \text{ kg/m}$$

n

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$$M - \theta$$

n

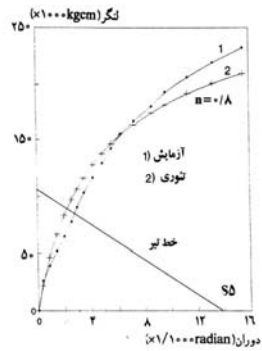
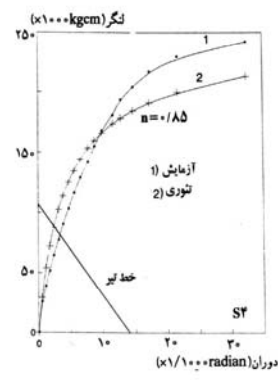
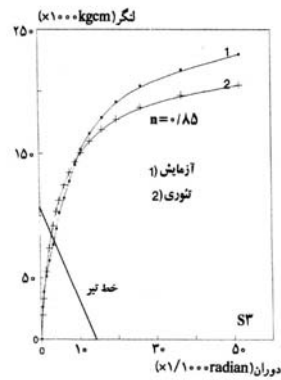
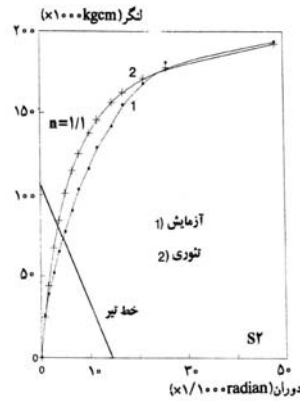
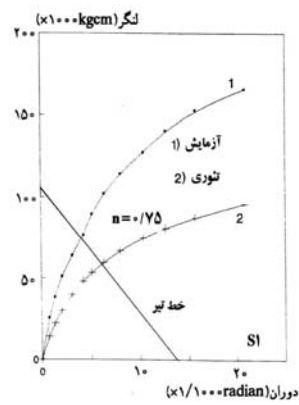
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()

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n

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$$\theta = \frac{M'}{M_{FM}} \times 100 \quad () \quad \theta_{th} \quad ()$$

M_{FM} θ_{ex} M_{th} M'_{ex} ()
 $M - \theta$

	M_{FM} t.cm	M'_{ex} t.cm	M'_{th} t.cm	α_{ex} %	α_{th} %	
S		/	/		/	
S		/	/	/	/	
S		/	/	/		
S		/	/	/	/	
S		/	/		/	

a'

h

t_a

$c = a - a'$

$k = \frac{1}{3}$

b_f

α_{th}

α_{ex}

M'_{th}

M'_{ex}

$M_{FM} = \frac{wL^2}{12}$

$M(\theta_r)$

$() \quad \theta_r$

$M_u \quad () \quad R_{ki}$

$\theta_o \quad ()$

$n = 0.85 \quad n$

θ

R_{ki}

R_{kp}

n

M_u

b

a

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