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چکیده

(Yoshida)

واژه های کلیدی:

مقدمه

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روش تحقیق

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نیروهای اعمالی

$$P_z = \frac{T_x R_y + T_y R_x}{R_y R_x} \quad ()$$

Y X

R_y R_x

()

m

$$\sigma_x - \sigma_z = m\sigma_f \quad -C \leq Z \leq \frac{t}{2} \quad ()$$

$$\sigma_z - \sigma_x = m\sigma_f \quad \frac{-t}{2} \leq Z \leq -C \quad ()$$

()-() ()

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$$\sigma_{xi} = -P_z - \sigma_f \left[m + Ln \left[\left(\frac{R_x + z}{R_{xi}} \right)^m \left(\frac{R_y + z}{R_{yi}} \right) \right] \right] \quad ()$$

$$\sigma_{yi} = -P_z - \sigma_f \left[1 + Ln \left[\left(\frac{R_x + z}{R_{xi}} \right)^m \left(\frac{R_y + z}{R_{yi}} \right) \right] \right] \quad ()$$

$$\sigma_{zi} = -P_z - \sigma_f \left[Ln \left[\left(\frac{R_x + z}{R_{xi}} \right)^m \left(\frac{R_y + z}{R_{yi}} \right) \right] \right] \quad ()$$

$$\sigma_{xii} = \sigma_f \left[m + Ln \left[\left(\frac{R_x + z}{R_{x0}} \right)^m \left(\frac{R_y + z}{R_{y0}} \right) \right] \right] \quad ()$$

$$\sigma_{yii} = \sigma_f \left[1 + Ln \left[\left(\frac{R_x + z}{R_{x0}} \right)^m \left(\frac{R_y + z}{R_{y0}} \right) \right] \right] \quad ()$$

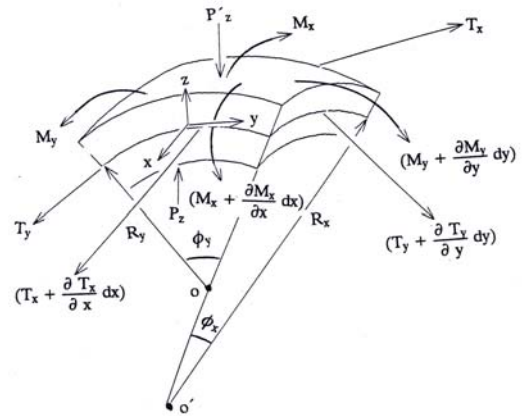
$$\sigma_{zii} = \sigma_f \left[Ln \left[\left(\frac{R_x + z}{R_{x0}} \right)^m \left(\frac{R_y + z}{R_{y0}} \right) \right] \right] \quad ()$$

جابجایی محور خنثی

z

$$e^{\frac{P_z}{\sigma_f}} = \frac{(R_x - C)^{2m} (R_y - C)^2}{R_{xi}^m R_{x0}^m R_{yi} R_{y0}} \quad ()$$

C



تغییرات ضخامت در حین تغییر شکل

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$$t = Z_{0.5} + 0.5t_0 \quad ()$$

روابط تعادل

$$\frac{d\sigma_z}{dz} = (\sigma_x - \sigma_z)k_x + (\sigma_y - \sigma_z)k_y \quad ()$$

$$k_y = 1/R_y \quad k_x = 1/R_x$$

$$\sigma_y - \sigma_z = \sigma_f \quad -C \leq Z \leq \frac{t}{2} \quad ()$$

$$\sigma_z - \sigma_y = \sigma_f \quad \frac{-t}{2} \leq Z \leq -C \quad ()$$

σ_f

$$E = E_0 e^{\left(e \bar{\varepsilon}^{-3} + f \bar{\varepsilon}^2 + g \bar{\varepsilon} \right)} \quad ()$$

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g f e

$$C = R_Y - \sqrt{R_{Yi} R_{Yo} e^{\frac{-P_z}{\sigma_f}}} \quad ()$$

[]

محاسبه مقدار m

() ()

(F f)

$$f = \frac{3}{2} (S - \alpha) : (S - \alpha) - Y^2 \quad ()$$

$$F = \frac{3}{2} (S - \beta) : (S - \beta) - (B + R)^2 = 0$$

β α Y

R B

$$T_x = \int_{-\frac{t}{2}}^{-C} \sigma_{xl} dz + \int_{-C}^{\frac{t}{2}} \sigma_{xll} dz$$

$$T_y = \int_{-\frac{t}{2}}^{-C} \sigma_{yl} dz + \int_{-C}^{\frac{t}{2}} \sigma_{yll} dz \quad ()$$

T_y T_x

$$T_y - T_x = \int_{-\frac{t}{2}}^{-C} (m-1) \sigma_f dz + \int_{-C}^{\frac{t}{2}} (1-m) \sigma_f dz \quad ()$$

m

محاسبه کرنشها

$\alpha^* = \alpha - \beta$

$$\alpha^* = \sqrt{\frac{2}{3} C a p \left[\mathbf{n}_p - \sqrt{\frac{\alpha^*}{a}} \mathbf{n}_* \right]} \quad ()$$

$$\bar{\alpha}^* = \sqrt{\frac{3}{2} \alpha^* : \alpha^*}$$

$$\dot{p} = \sqrt{(2/3) D^p : D^p} \quad a = B + R - Y$$

C'

$$\varepsilon_x = \ln \left(1 + \frac{z+C}{R_x} \right) + \frac{1}{E} \left(\frac{T_x}{t} - \nu \frac{T_y}{t} \right)$$

$$\varepsilon_y = \ln \left(1 + \frac{z+C}{R_y} \right) + \frac{1}{E} \left(\frac{T_x}{t} - \nu \frac{T_y}{t} \right) \quad ()$$

$$\varepsilon_z = \ln \left(\frac{t}{t_0} \right) - \frac{\nu}{E} \frac{T_x + T_y}{t}$$

ε_y ε_x

T_y T_x

$$\frac{R_x O^{(T_x - \nu T_y)} - R_y O^{(T_y - \nu T_x)}}{(R_x - R_y)} = 1 \quad ()$$

$$O = e^{\frac{-1}{tE}}$$

ε_z

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معادلات برگشت فنری

m

$$\bar{\varepsilon} = \frac{1+r}{\sqrt{1+2r}} \sqrt{\varepsilon_x^2 + \varepsilon_y^2 + \frac{2r}{1+r} \varepsilon_x \varepsilon_y} \quad ()$$

محاسبه تنش سیلان

$$M_x = \int_{-\frac{t}{2}}^{-C} \sigma_{xl} Z dz + \int_{-C}^{\frac{t}{2}} \sigma_{xll} Z dz \quad ()$$

روش آزمایشگاهی

$$M_y = \int_{-t/2}^{-c} \sigma_{yl} Z dz + \int_{-c}^{t/2} \sigma_{yII} Z dz \quad ()$$

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$$M_x - \Delta M_x = 0 \quad ()$$

$$M_y - \Delta M_y = 0$$

SPCC

:

$$\Delta M_x = \int_{-t/2}^{t/2} \frac{E}{1-\nu^2} \Delta \varepsilon_x Z dz \quad ()$$

$$\Delta M_y = \int_{-t/2}^{t/2} \frac{E}{1-\nu^2} \Delta \varepsilon_y Z dz \quad ()$$

CATIA

روش عددی محاسبات

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نتایج و بحث

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به SPCC

ورقهای فولادی با کیفیت مناسب برای شکلدهی براساس استاندارد JIS G3141 (اطلاق می گردد)

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(t/2)

(-t/2)

)

(

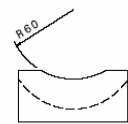
SPCC

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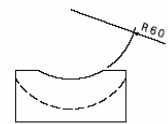
E_0 (GPa)	ν	Y (MPa)	c
	/		
B (MPa)	R_{sat} (MPa)	b (MPa)	m

:

(mm)	(Kg)		(mm)		
t	T_y	T_x	R_y	R_x	
/		/			
/		/			
/		/			



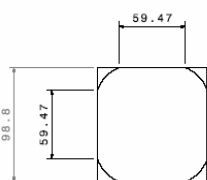
Front view



Left view

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Top view

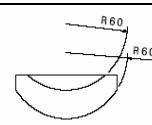


Isometric view

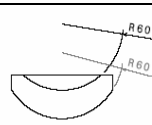
y x

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y x

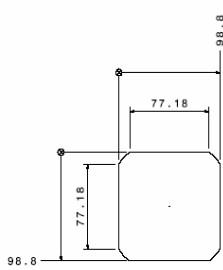


Front view



Left view

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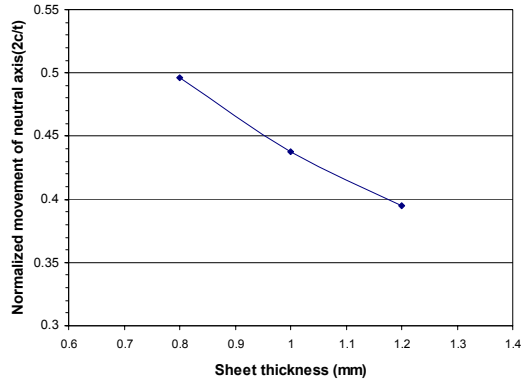


Top view



Isometric view

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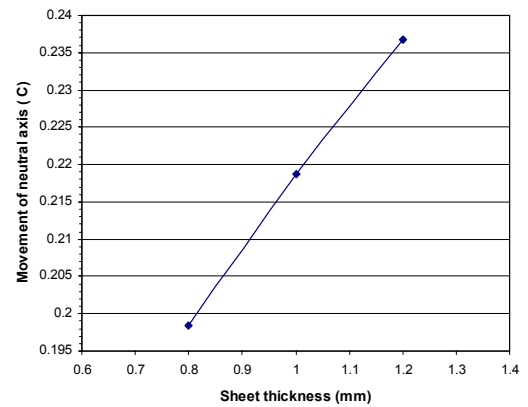
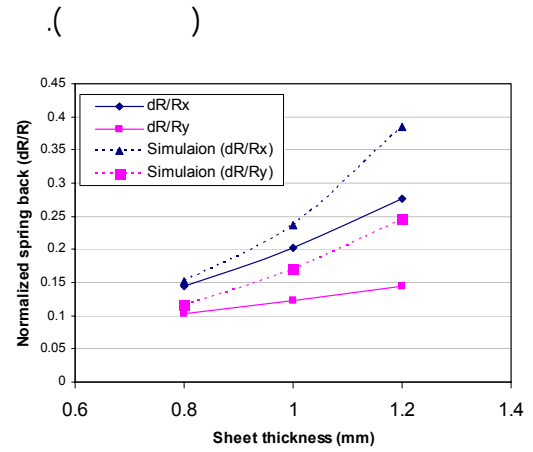


(2C/t)

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نتیجه گیری



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