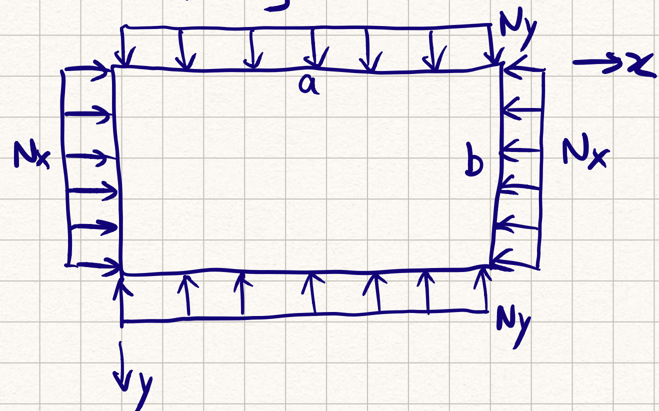
(2) SS all edges, Rectangular Plate [SS-SS-SS-SS]

Uniformly compressed, in two perpendicular directions



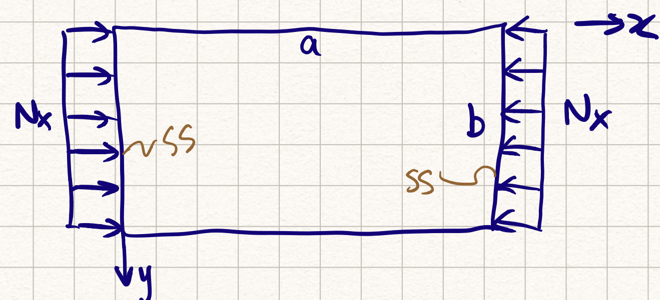
N_x: compressive force per unit length

Equation not obvious to use

So, we need to find some other expressions.

(3) Uniformly compressed, Rectangular plates

SS along 2 opposed sides perpendicular to the direction of compression, various edge BCs along the other 2 sides.



$$\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4} = -\frac{N_x}{D}\frac{\partial^2 w}{\partial x^2}$$

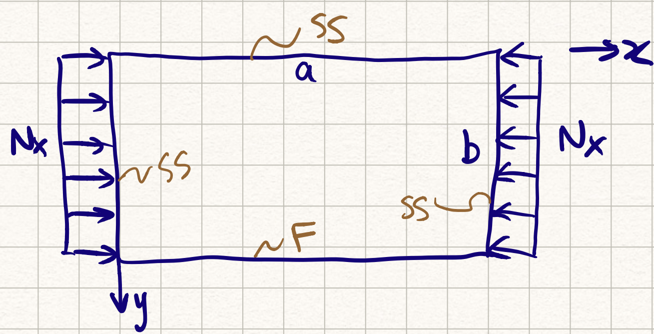
assume $w = f(y) \cdot \sin\frac{m\pi x}{a}$

BCs: @ $x=0$ & $x=a$, $w=0$ & $\frac{\partial^2 w}{\partial x^2} + \nu \frac{\partial^2 w}{\partial y^2} = 0$

$$\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4} = -\frac{N_x}{D}\frac{\partial^2 w}{\partial x^2} \Rightarrow \text{ODE}$$

$w = f(y) \cdot \sin\frac{m\pi x}{a}$

① SS − F − SS − SS



$$\beta\left(\alpha^2 - \nu\frac{m^2\pi^2}{a^2}\right)^2 \cdot \tanh \alpha b = \alpha\left(\beta^2 + \nu\frac{m^2\pi^2}{a^2}\right)^2 \tanh \beta b$$

where $\alpha = \sqrt{\frac{m^2\pi^2}{a^2} + \sqrt{\frac{N_x}{D}\frac{m^2\pi^2}{a^2}}}$

$\beta = \sqrt{-\frac{m^2\pi^2}{a^2} + \sqrt{\frac{N_x}{D}\frac{m^2\pi^2}{a^2}}}$

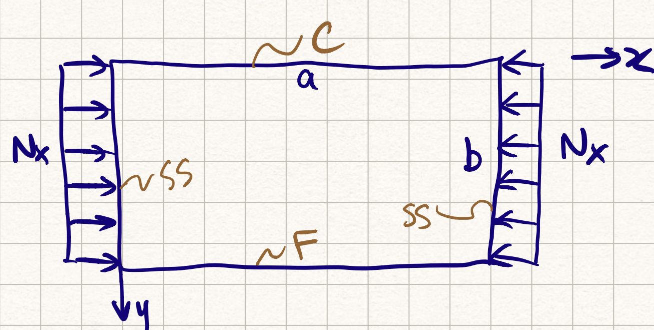
$\Rightarrow N_x \xrightarrow{\min} (N_x)_{cr}$

take $m=1$

$$(\sigma_x)_{cr} = \frac{(N_x)_{cr}}{h} = k\frac{\pi^2 D}{b^2 h}$$

For long plate, $a \gg b$, we can use $k = \left(0.456 + \frac{b^2}{a^2}\right)$

② SS − F − SS − C



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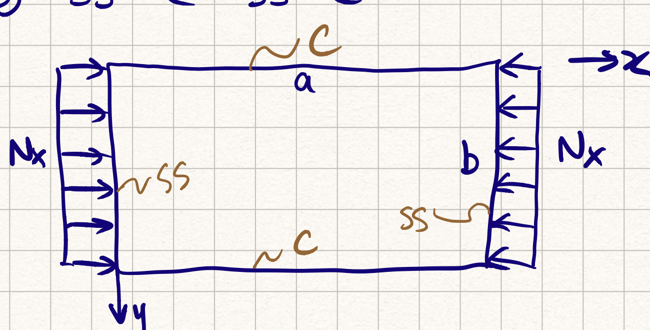
Equations too complicated

③ SS − C − SS − C



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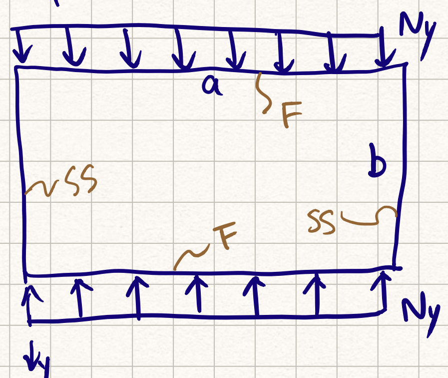
Only numerical solution is given.

(3) Uniformly compressed, Rectangular plates

SS along 2 opposed sides Parallel to the direction of compression, unsupported on the rest 2 edges



$\rightarrow x$

$$\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4} = -\frac{N_y}{D}\frac{\partial^2 w}{\partial y^2}$$

See book

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Only numerical solution is given.