$$\sum M_A = Fc - M_N - M_f = 0 \qquad \Rightarrow \qquad F = \frac{M_N + M_f}{c} \qquad \Rightarrow \qquad (Self-de-energizing)$$

$$R_x = \frac{brp_{\text{max}}}{\sin \theta_{\text{max}}} (A + fB) - F_x$$

$$R_{y} = \frac{brp_{\text{max}}}{\sin \theta_{\text{max}}} (B - fA) - F_{y}$$

where:

$$A = \int_{\theta_1}^{\theta_2} \sin \theta \cos \theta \, d\theta = \left(\frac{1}{2} \sin \theta\right)_{\theta_1}^{\theta_2}$$
$$B = \int_{\theta_1}^{\theta_2} \sin^2 \theta \, d\theta = \left(\frac{\theta}{2} - \frac{1}{4} \sin \theta\right)_{\theta_1}^{\theta_2}$$

Note: the reference is always in the center of the drum. The positive x-axis is taken through the hinge. The positive y-axis is always in the direction of the shoe.

Internal Shoe Drum Brake:

- Normally used in automotive rear wheel
- Energizing and de-energizing characteristics are determined by:
 - 1- Noting the direction of friction force acting upon the shoe surface
- 2- Determining if this force tends to bring the shoe into or out of contact of the drum For the left figure shown below:

Left shoe: self – energizing

Right shoe: self-de-energizing

In automotive brakes -> self-energizing is desired -> decrease pedal force

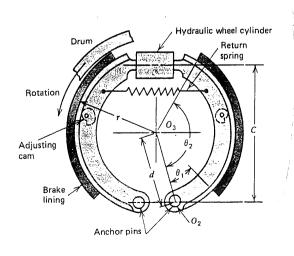
But self-locking must be avoided

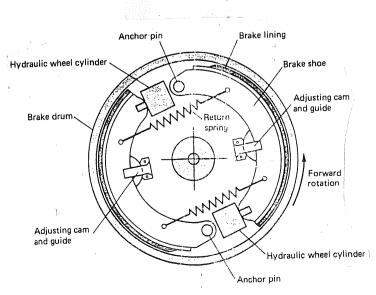
Improved Design:

The shoes are inverted and each one is actuated by a separate cylinder.

This arrangement will increase the self- energizing action

- → Both shoes are self-energizing in forward car motion.
- → This arrangement is used in automotive front wheels.





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