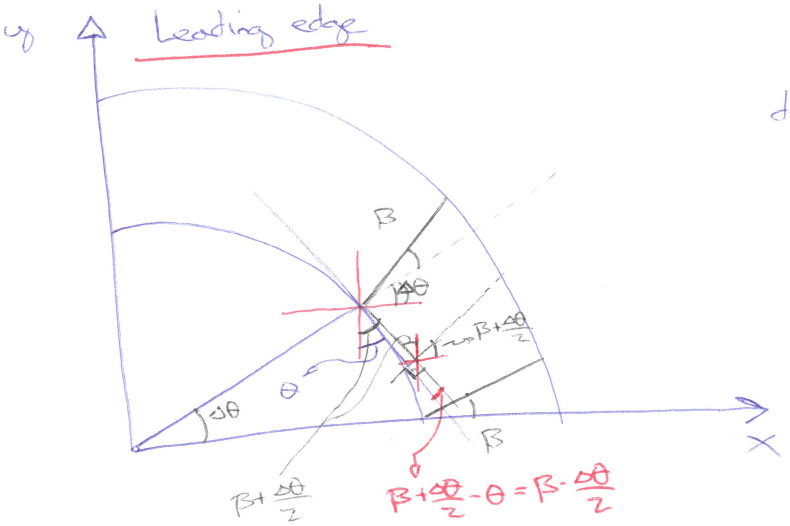
Cosine rule in a radial cascade

The cosine rule is a well-known method to estimate the throat area in axial cascades. This rule can be modified so that it can also be used to estimate the throat area in radial cascades.

Leading edge

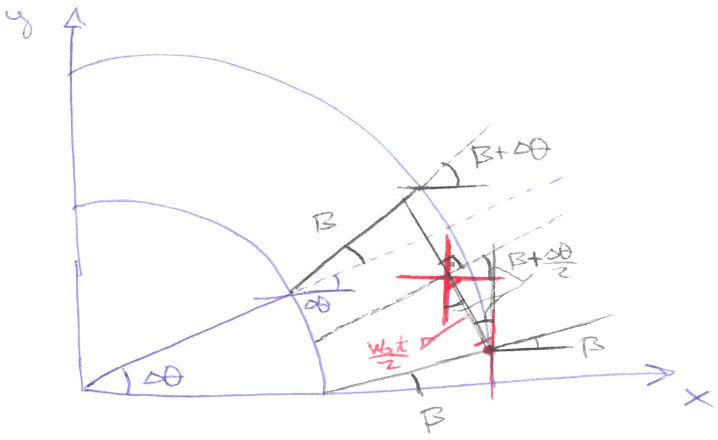


From the geometry of the diagram we see that

$$\frac{W_{in}}{2} \approx \frac{s_{in}}{2} \cdot \cos\left(\beta - \frac{\Delta\theta}{2}\right)$$

$$W_{in} \approx r_{in} \cdot \Delta\theta \cdot \cos\left(\beta - \frac{\Delta\theta}{2}\right)$$

Trailing edge



From the geometry of the figure we see that

$$\frac{W_{out}}{2} \approx \frac{s_{out}}{2} \cdot \cos\left(\beta + \frac{\Delta\theta}{2}\right)$$

$$W_{out} \approx r_{out} \cdot \cos\left(\beta + \frac{\Delta\theta}{2}\right) \cdot \Delta\theta$$

These formulas give very good approximations for straight channels. The approximation is not as good when the blades are curved.