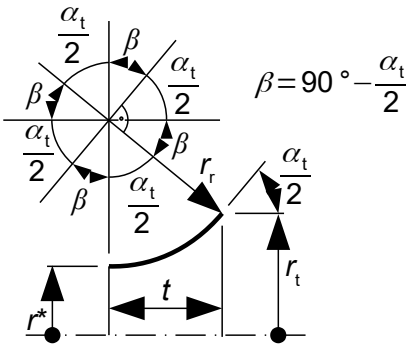
APPENDIX 993: Fluid dynamics, Flow of gases and steam through nozzles, Derivation of equation for calculation of inlet part of divergent section of Laval nozzle

The derivation of the equations for the design of the neck of the divergent part of the Laval nozzle can be done methodically according to the attached figure:



The length of the arc in the direction of the axis indicated by the letter *t* will be:

$$t = r_r \cdot \sin\frac{\alpha_t}{2}.$$

The diameter of the nozzle at the end of the arc r_t can be derived from the equality of lengths:

$$r^* + r_r = r_t + r_r \cdot \cos\frac{\alpha_t}{2}$$

$$r_t = r^* + r_r - r_r \cdot \cos\frac{\alpha_t}{2} = r^* + r_r\left(1 - \cos\frac{\alpha_t}{2}\right).$$