

DYNAMICS OF THE LINEAR PNEUMATIC ACTUATOR COMPUTER SIMULATION

SYMBOL	NAME	UNIT	VALUE
D	piston diameter	[m]	0.063
d	piston rod diameter	[m]	0.020
S	piston stroke	[m]	0.100
m	mass load	[kg]	parameter
F	force load	[N]	parameter
f	inlet area = outlet area	[m ²]	parameter
μ ₁	inlet flow coefficient (1)	[-]	parameter
μ ₂	outlet flow coefficient (2)	[-]	parameter
p _Z	supply pressure	[Pa]	parameter
p _a	ambient pressure	[Pa]	100000
p ₁	pressure in the inlet chamber (1)	[Pa]	result of simulation
p ₂	pressure in the outlet chamber (2)	[Pa]	result of simulation
s	piston position	[m]	result of simulation
v	piston velocity	[m/s]	result of simulation
t	time line	[s]	result of simulation

MASS AIR-FLOW MODEL St. Venant-Wantzel

$$\dot{m} = \mu \cdot f \cdot p_A \cdot \sqrt{\frac{\kappa}{R \cdot T_0}} \cdot \sqrt{\frac{2}{\kappa - 1}} \cdot \Phi(\varepsilon) \quad \varepsilon = \frac{p_B}{p_A} \quad \Phi(\varepsilon) = \begin{cases} \sqrt{\frac{2}{\varepsilon^{\frac{2}{\kappa}} - \varepsilon^{\frac{\kappa+1}{\kappa}}}} & \text{for } 0.52828 < \varepsilon \leq 1 \\ 0.25880 & \text{for } 0 < \varepsilon \leq 0.52828 \end{cases}$$

for the inlet chamber: μ = μ₁ p_A = p_Z p_B = p₁

for the outlet chamber: μ = μ₂ p_A = p₂ p_B = p_a