DYNAMICS OF THE LINEAR PNEUMATIC ACTUATOR
COMPUTER SIMULATION

SYMBOL	NAME	UNIT	VALUE
D	piston diameter	[m]	0.100
d	piston rod diameter	[m]	0.032
S	piston stroke	[m]	0.025
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

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

for the inlet chamber: $\mu = \mu_1$ $p_A = p_Z$ $p_B = p_1$
for the outlet chamber: $\mu = \mu_2$ $p_A = p_2$ $p_B = p_a$