Calculates how a bullet from a AK4 reaccelerates

$m := 0.075$ Mass of the bullet

$cw := 0.15$ Coefficient of flow resistance

$\rho := 1.2$ Density of the air at 20 degrees (no wind)

$A := \frac{0.00762^2 \pi}{4}$ Frontarea of the bullet 7.62 mm

$v0 := 810$ Initial value of the speed from the rifle

The describing differential equation below. Uses the law F=m*a. The second derivate is acceleration and the firs derivate is the speed. I calculate the force from the wind uses the Bernoulli equation.

$$m \cdot s'' + \frac{\rho \cdot A \cdot cw \cdot s'^2}{2} = 0$$

The describing diff below is when I stated it, with respect to a energy balances. V0 is the initial speed of the bullet. I believe the solutions differ to each other and you must messure with solution who fit best.

$$m \cdot s'^2 = m \cdot v0^2 - \rho \cdot A \cdot cw \cdot s'^2 \cdot s$$

Given

$$\frac{d^2}{dt^2} s(t) = \frac{-\left(\frac{d}{dt} s(t)\right)^2 \cdot A \cdot cw \cdot \rho}{2 \cdot m}$$

Here I formulate the differential equation for describing the reaccelation of the bullet. The second derivate of the length is the reacceleration and that depensds on the dynamic pressure rise the area, densety, and cw value. The first derivate is the speed. And when I divide with the mass, I got the reaccelation.

$s(0) = 0$ $s'(0) = v0$

$s := \text{odesolve}(t, 15, 200)$

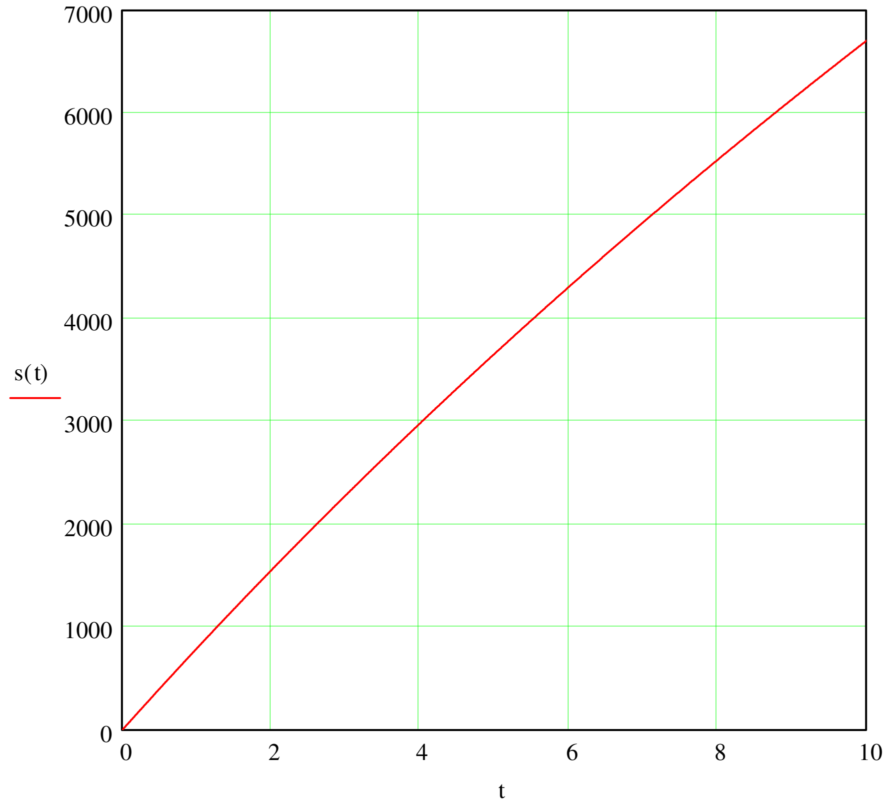
Here I solve the differetialequation, when time goes from 0 to 15 s, and I solve i with 200 calculations points.

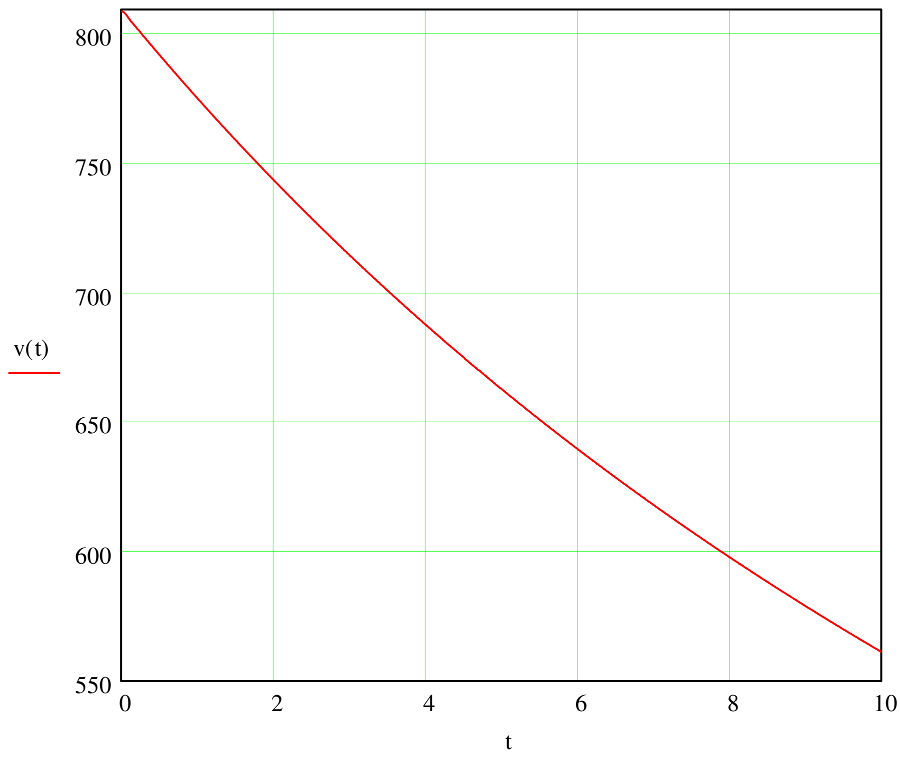
$v(t) := \frac{d}{dt} s(t)$

$\text{root}(s(t) - 1000, t, 0, 5) = 1.269$ The time for the bullet to reach 1000 m

$s(1) = 792.561$ The length the bullet reach about 1 sec

$v(2.242) = 736.778$ ´The speed of the bullet about 2.242 sec


7000
6000
5000
4000
s(t)
3000
2000
1000
0
0
2
4
6
8
10
t


800
750
700
v(t)
650
600
550
0
2
4
6
8
10
t