Skydiver

Fluxion Example Description

1 Physical Background

The following definitions, which are commonly used in Newtonian physics, hold for this example

$$y' = v \tag{1}$$

$$v' = a \tag{2}$$

The following equation defines the resulting acceleration by adding the negative gravitational acceleration, $\hat{g}$, and the acceleration due to friction, k, acting in the opposing direction:

$$a = -(\hat{g} - k) \tag{3}$$

The air friction is modeled using the Newtonian quadratic drag:

$$F_R = \frac{1}{2} \cdot c_w \cdot A \cdot \rho \cdot v^2 \tag{4}$$

Here, all the constants (c_w, A, and ρ) are absorbed into one, c. In the simulation, the frictional force before opening the parachute is neglected, i.e. c is set to 0. When opening the parachute, the area A and thus also the frictional force increases. We model the opening of the parachute with a parabola:

$$c = 0.01 \cdot (t - 5)^2 \tag{5}$$

Once the parachute has been fully opened, in our case once a value of 0.25 has been reached (this occurs after t = 10 s), c is set constant.

2 Simulation

Using a conditional variable (see "Additional definitions"), c starts to increase after 5 seconds of the skydiver being in the air, up to this point c was equal to 0. Then the parameter was set equal to cc. This additional conditional variable describes the time (which in this case takes another 5 seconds) during which the parachute is opening using the function defined in (5), and the effect of the opened parachute afterwards.
For purposes of illustration and understanding, the effect of the conditional variable can be observed in the graphs displayed!