Glider Flight

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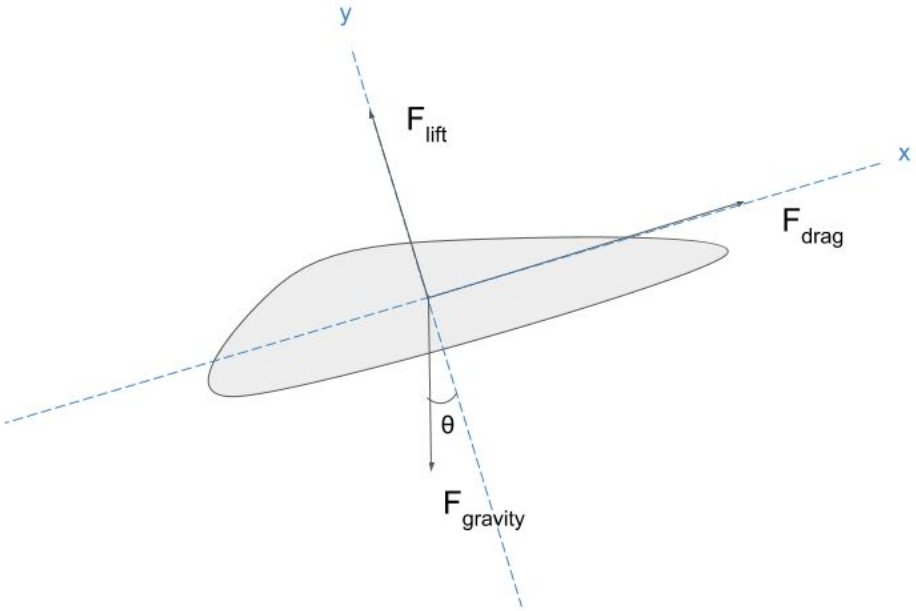
Q:

How does the initial velocity of a glider plane affect the distance traveled before reaching the ground?

M:



Assumptions:

- Air density remains constant with altitude
- Air is not moving
- No stall speed
- Coefficients of lift and drag not specific to this aircraft

Parameters

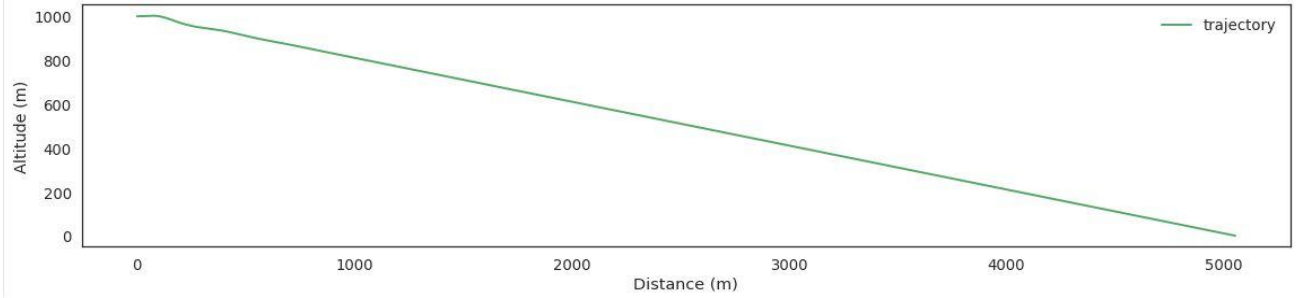
h_init, v_init, theta_init, g, rho,

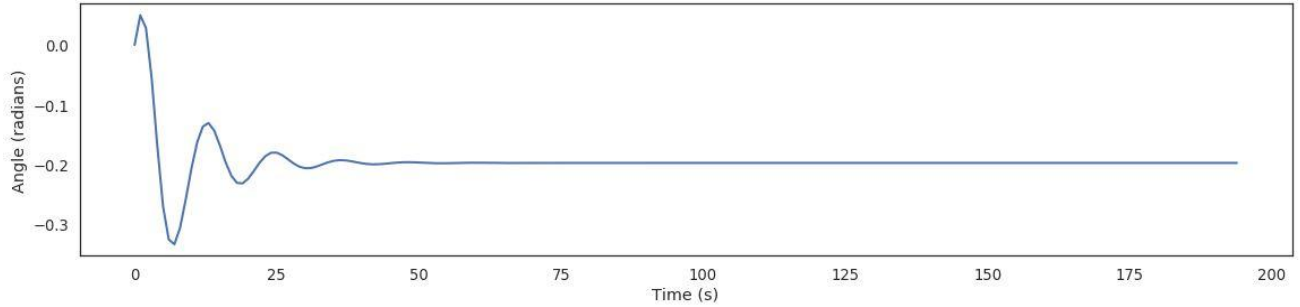
Schleicher ASK 13:
area, mass_min, mass_max, Cl, Cd

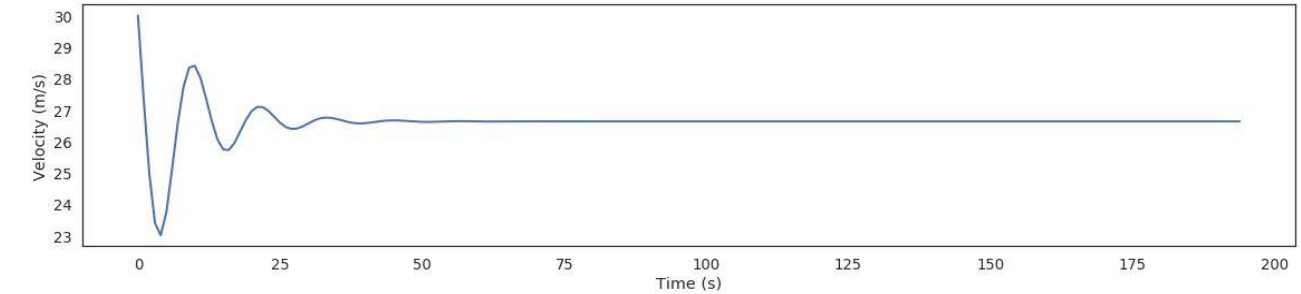
Equations

$$m\frac{dV}{dt} = -mg\sin\theta - \frac{1}{2}\rho V^2 C_D S$$
$$mV\frac{d\theta}{dt} = -mg\cos\theta + \frac{1}{2}\rho V^2 C_L S$$
$$\frac{dX}{dt} = V\cos theta$$
$$\frac{dY}{dt} = V\sin theta$$

R:

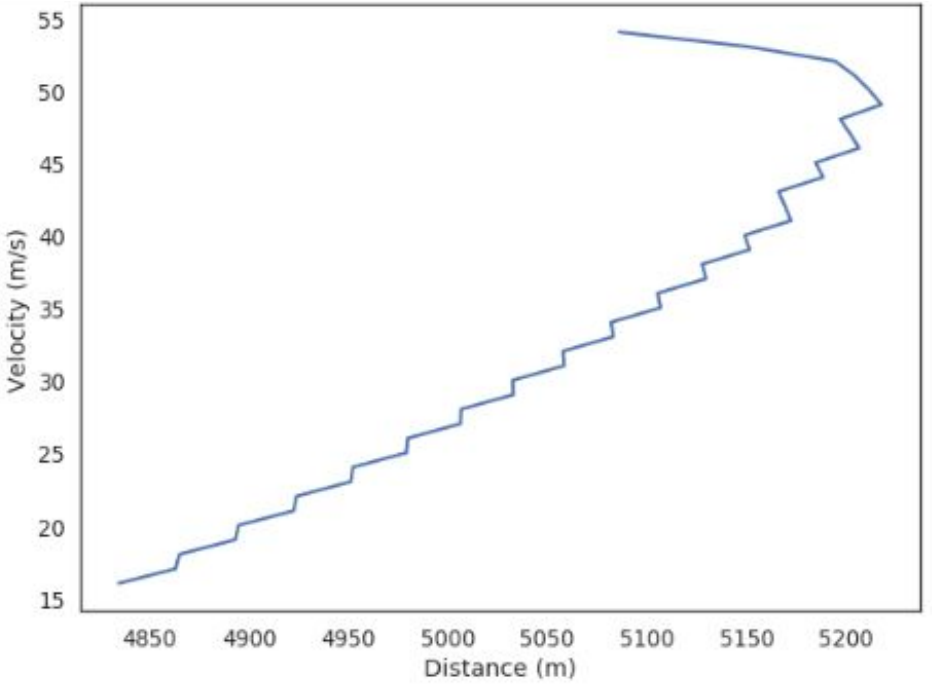

trajectory
Altitude (m)
1000
800
600
400
200
0
0
1000
2000
3000
4000
5000
Distance (m)


Angle (radians)
0.0
−0.1
−0.2
−0.3
0
25
50
75
100
125
150
175
200
Time (s)


Velocity (m/s)
30
29
28
27
26
25
24
23
0
25
50
75
100
125
150
175
200
Time (s)

R:

- Sweep init velocity, see how it impacts the rest of the flight
- As init velocity increases, distance increases
- Above 53 m/s the distance travelled decreases with the initial velocity



I:

Maximum recommended flight speed of this glider, the Schleicher ASK 13, is 55.1 m/s

Our sweep found that above 53 m/s the glider flies worse, which is consistent with the glider specification