System equations

---

Drag force

Ballistic coefficient

air density

---

**Nonlinear model**

**initial conditions**

For simplicity assume constant density:

reference trajectory

nominal solution

Where is such that

test solution.

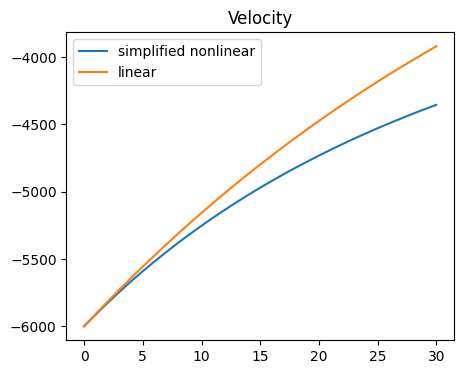
substitution of to the diff equations:

Correct.

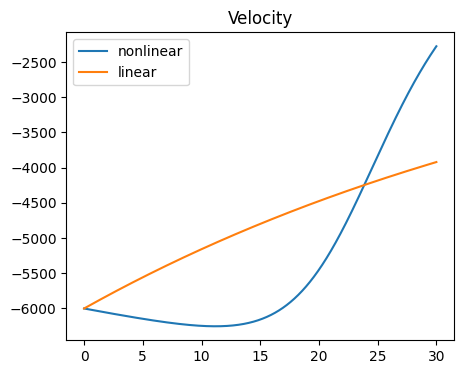
Linearization

Linearized equations:

Comparison: linear vs. simplified nonlinear system



Wrt full nln system:



Simplification #2

Let’s approximate the density function with a first order equation:

air density

x0, y­0

f(xn)

f(xn+dx)

x, y

xn xn+dx

Then the simplified nonlinear #2 system is:

reference trajectory

nominal solution

Where is such that

substitution of to the diff equations:

Correct.

Linearization

Let

Linear system:

Where

This solution is very bad how can we set v?

Linearized equations:

This linear system is nonobservable.

Let’s separate:

And try to observe only the higher yellow paert.

זה לא יעבוד כי המדידה היא על המיקום ואם לוקחים רק את הגובה ואת המקדם הבליסטי אז מטריצת הדינמיקה ריקה.