VehicleModels.jl Documentation

Release 0.0.1-rc1

Huckleberry Febbo

Apr 08, 2017

Contents

1 Installation **1**

2 Examples **3**

2.1 Using `DifferentialEquations.jl` to solve a set of ODEs 3

3 Tutorial **17**

4 Citation **19**

CHAPTER 1

Installation

In Julia, you can install the `VehicleModels.jl` package by typing:

```
Pkg.clone("https://github.com/huckl3b3rry87/VehicleModels.jl")
```

CHAPTER 2

Examples

The first example demonstrates moving obstacle avoidance for a large-sized high-speed ground vehicle.

Using `DifferentialEquations.jl` to solve a set of ODEs

In this example we use two small packages along with DifferentialEquations.jl that can be downloaded by typing:

```
Pkg.clone("https://github.com/huckl3b3rry87/VehicleModels.jl")
Pkg.clone("https://github.com/huckl3b3rry87/PrettyPlots.jl")
```

Then, the example can be ran by going into the examples folder and typing:

```
include("test.jl")
```

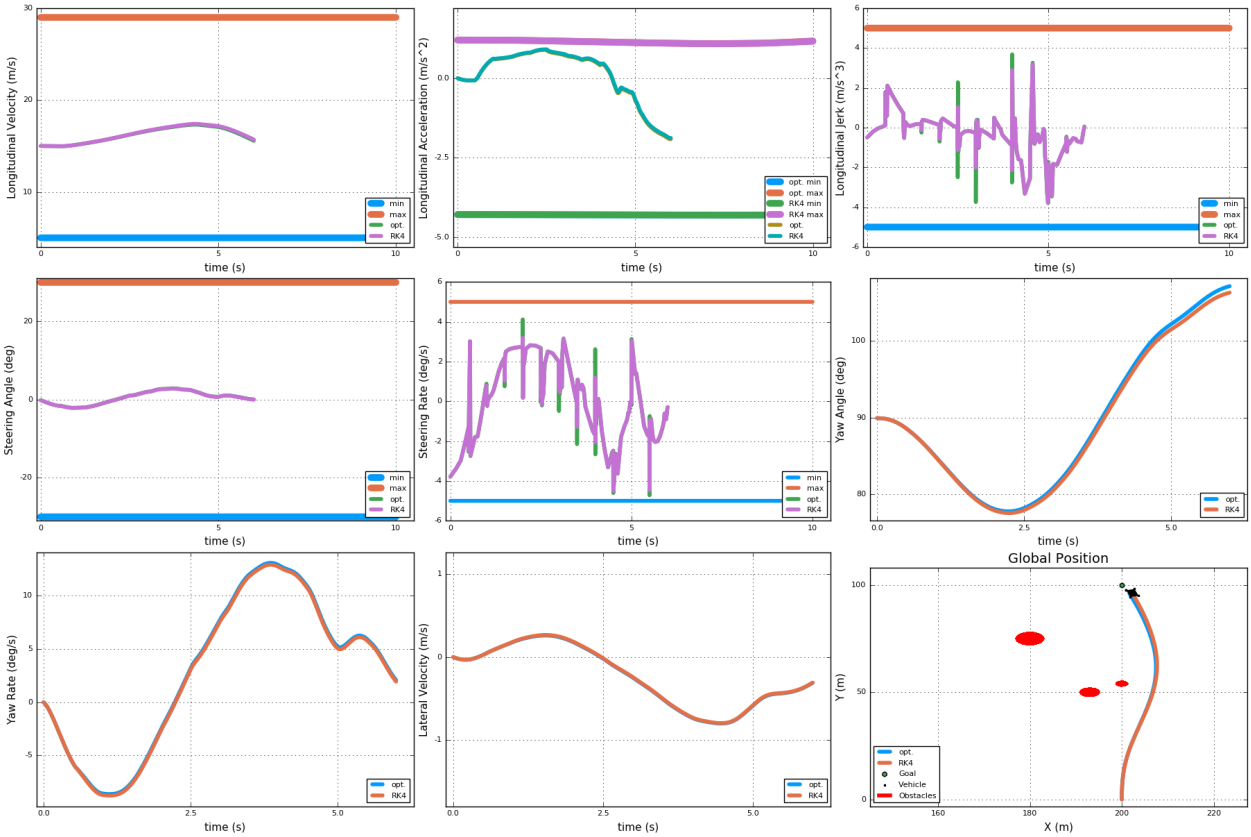
This is a mock example, but it demonstrates the utility of `DifferentialEquations.jl`.

What we are doing is passing the control signals (optimized steering rate and longitudinal jerk) for a large-sized ground vehicle to a set of differential equations that describe the vehicle dynamics.

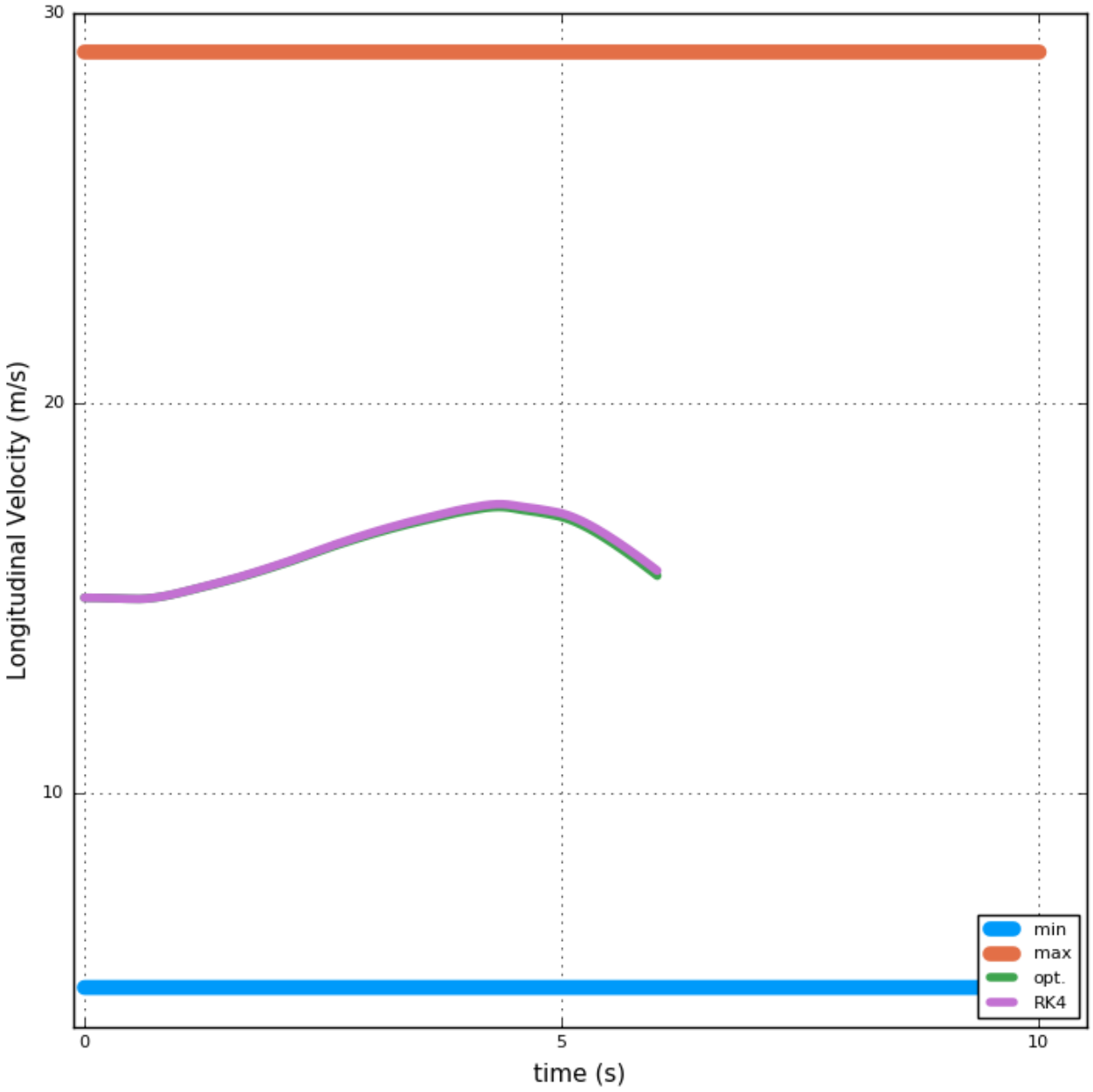
From the optimized data, we also have all of the states so we compare the results of the two models in this case. The two models should be very close, which they are for the most part, except where the optimized steering rate and longitudinal jerk are very jumpy.

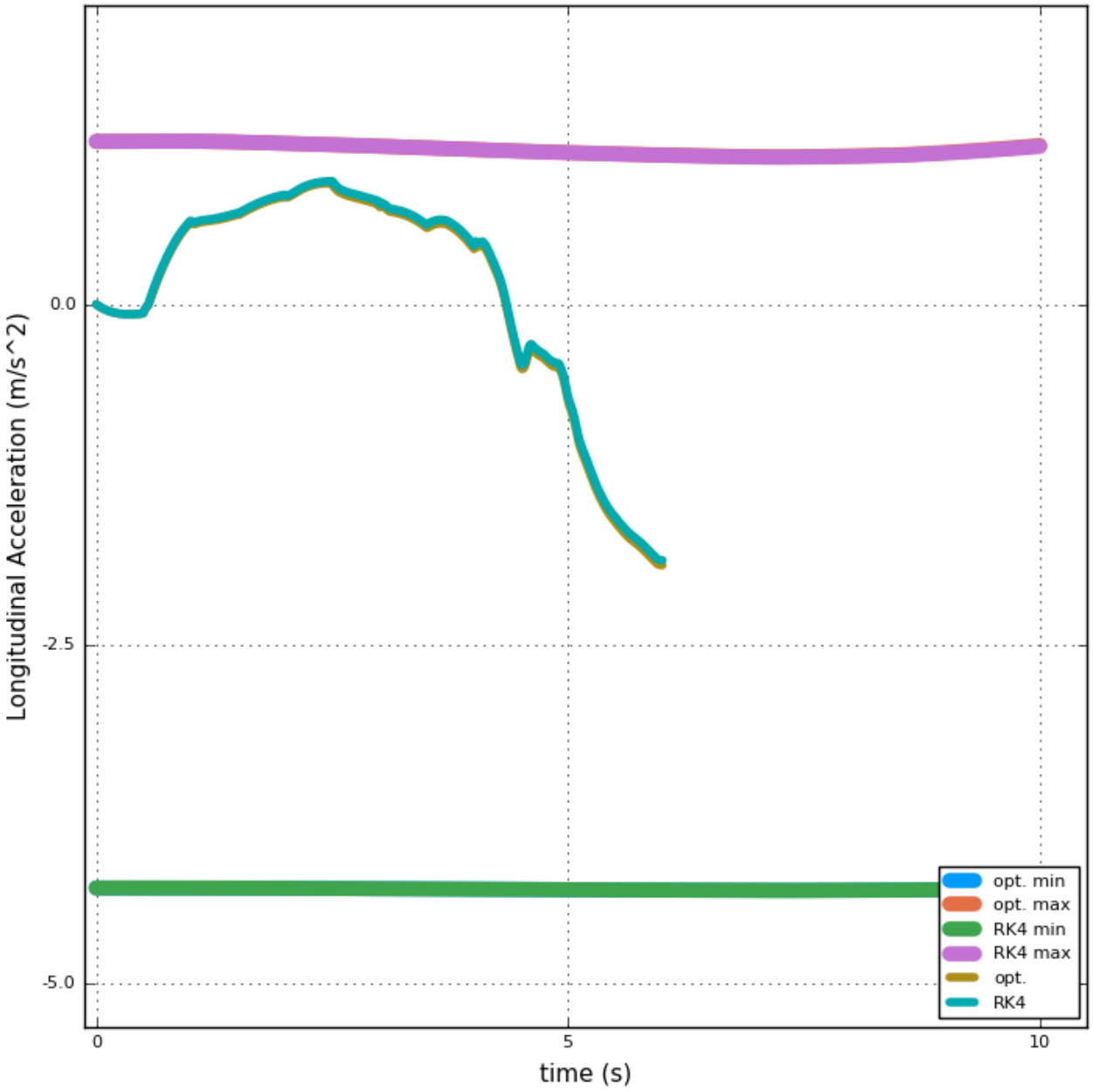
For a closer look at the end (last optimization) of the static plots, look below.

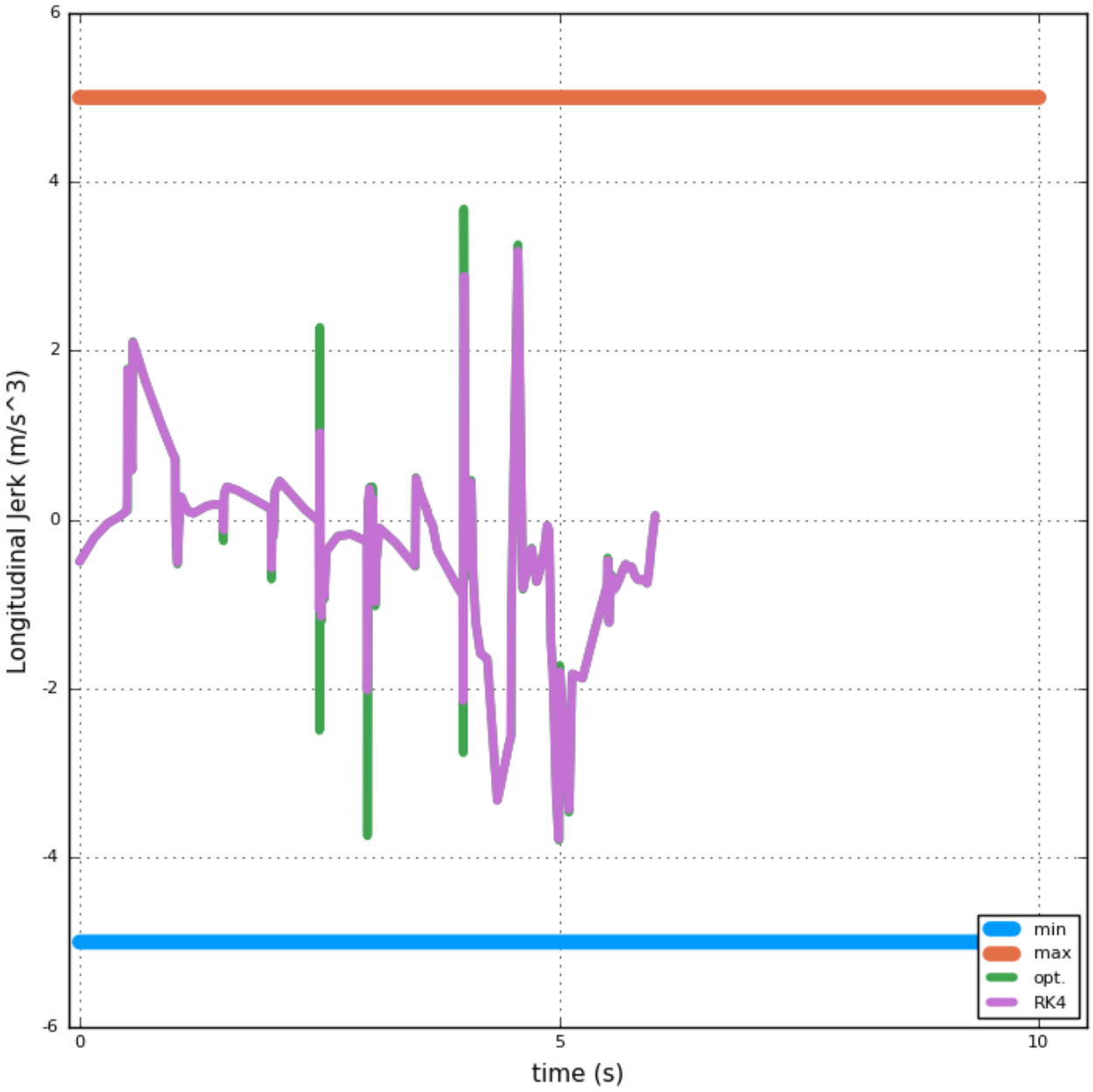
Taking a look at the states:

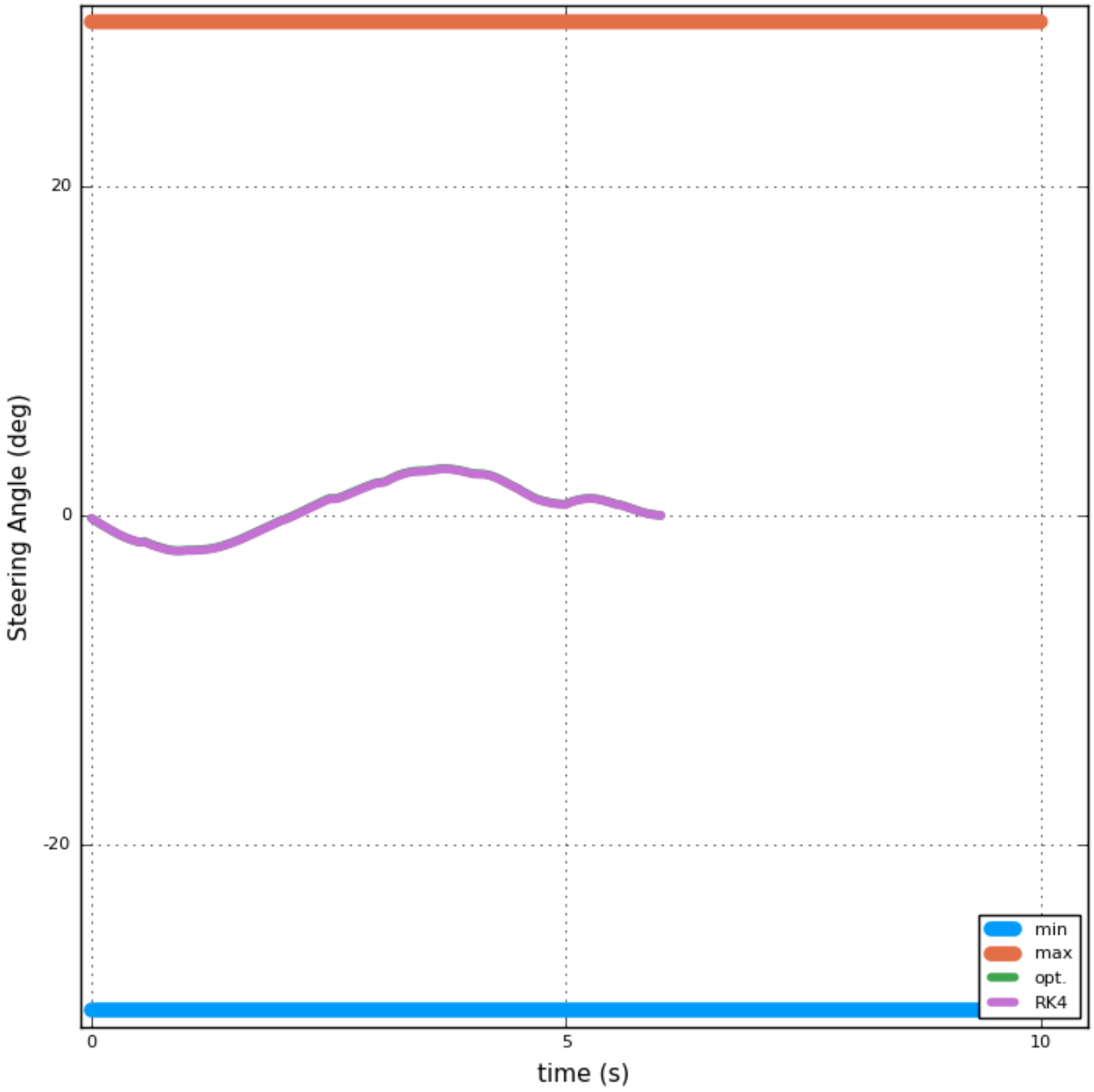


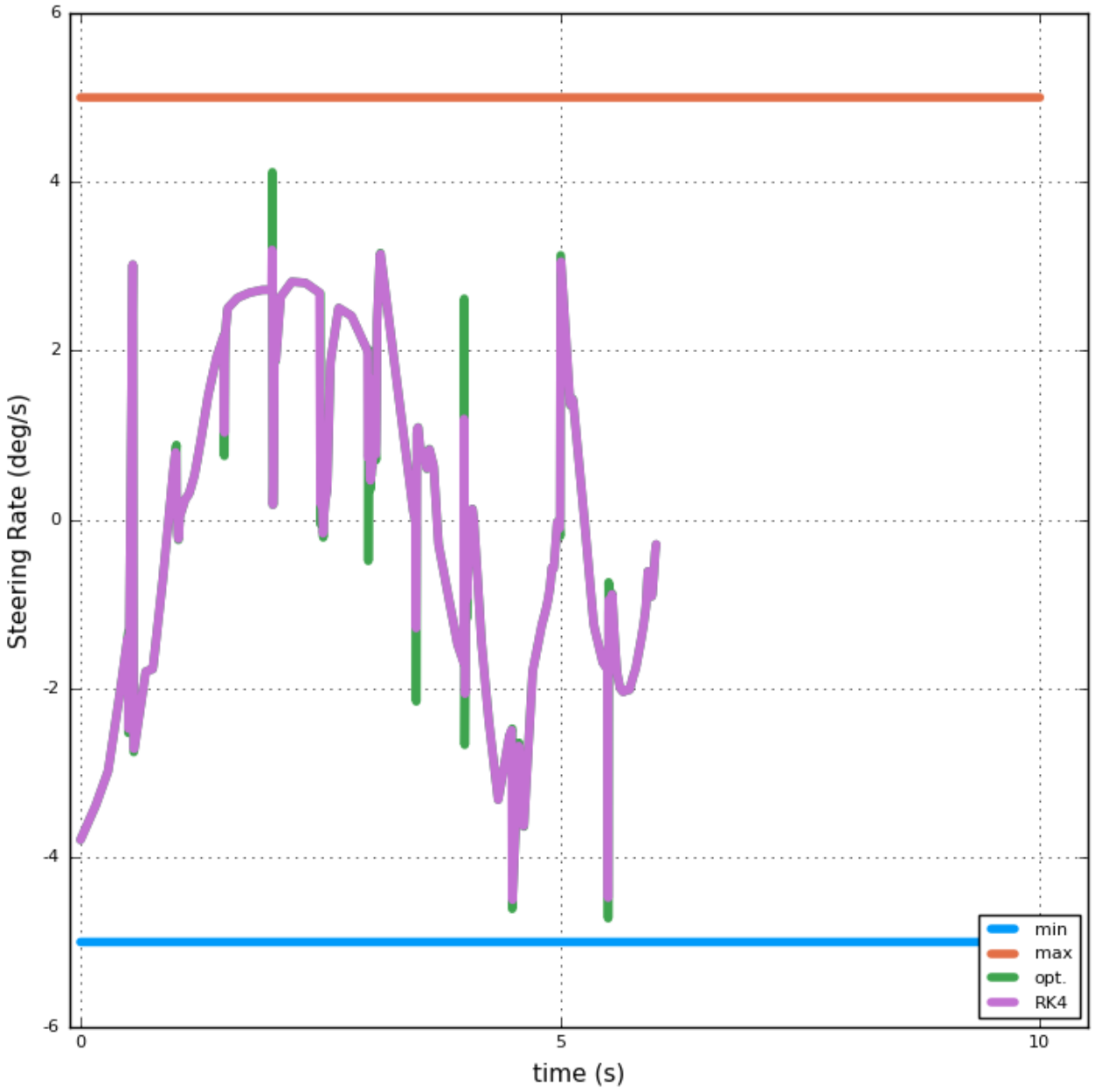
A closer look at the states and controls:

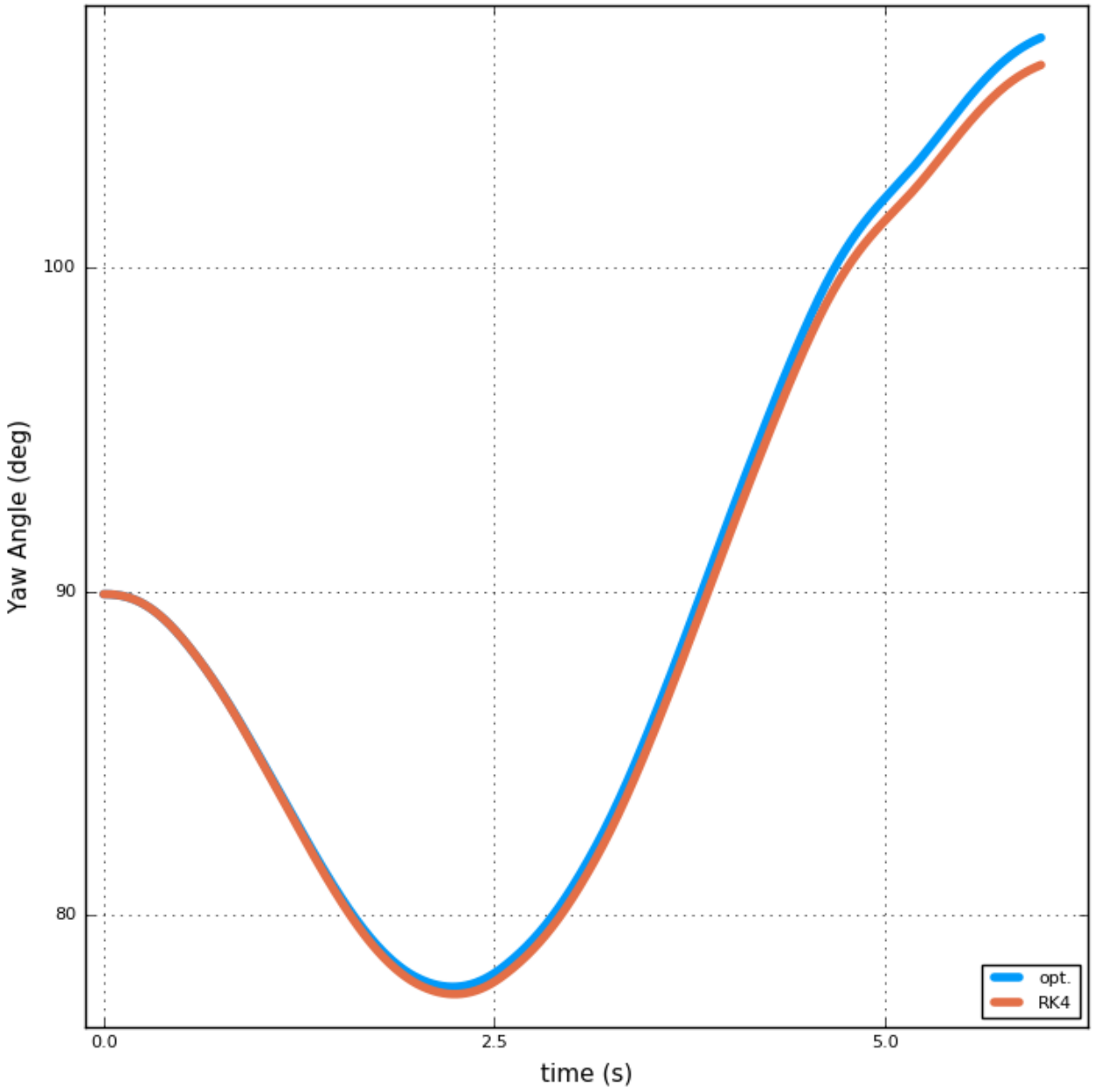

30
20
10
Longitudinal Velocity (m/s)
0
5
10
time (s)
min
max
opt.
RK4

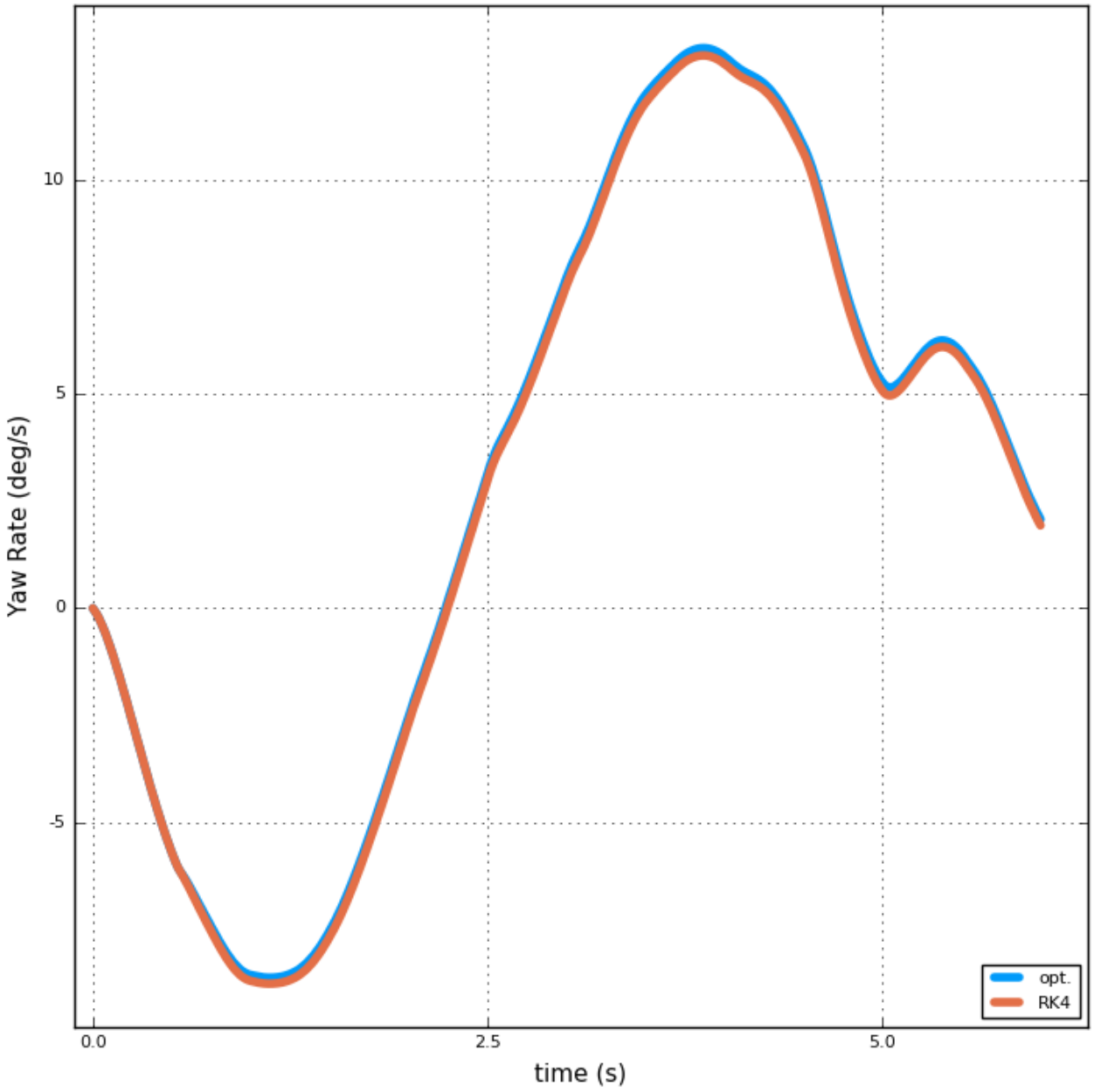

Longitudinal Acceleration (m/s^2)
0.0
-2.5
-5.0
0
5
10
time (s)
opt. min
opt. max
RK4 min
RK4 max
opt.
RK4

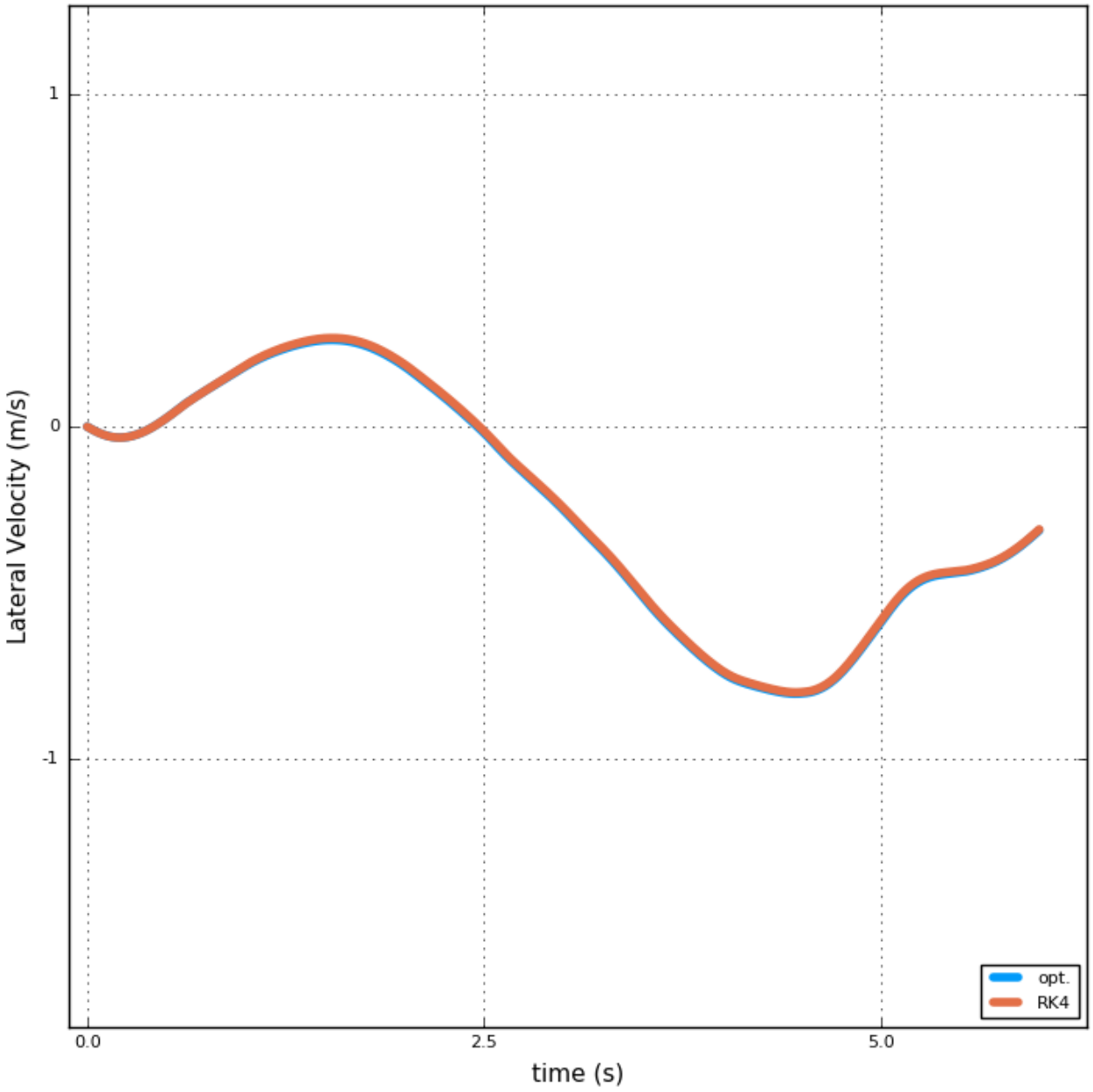

6
4
2
0
-2
-4
-6
Longitudinal Jerk (m/s^3)
0
5
10
time (s)
min
max
opt.
RK4

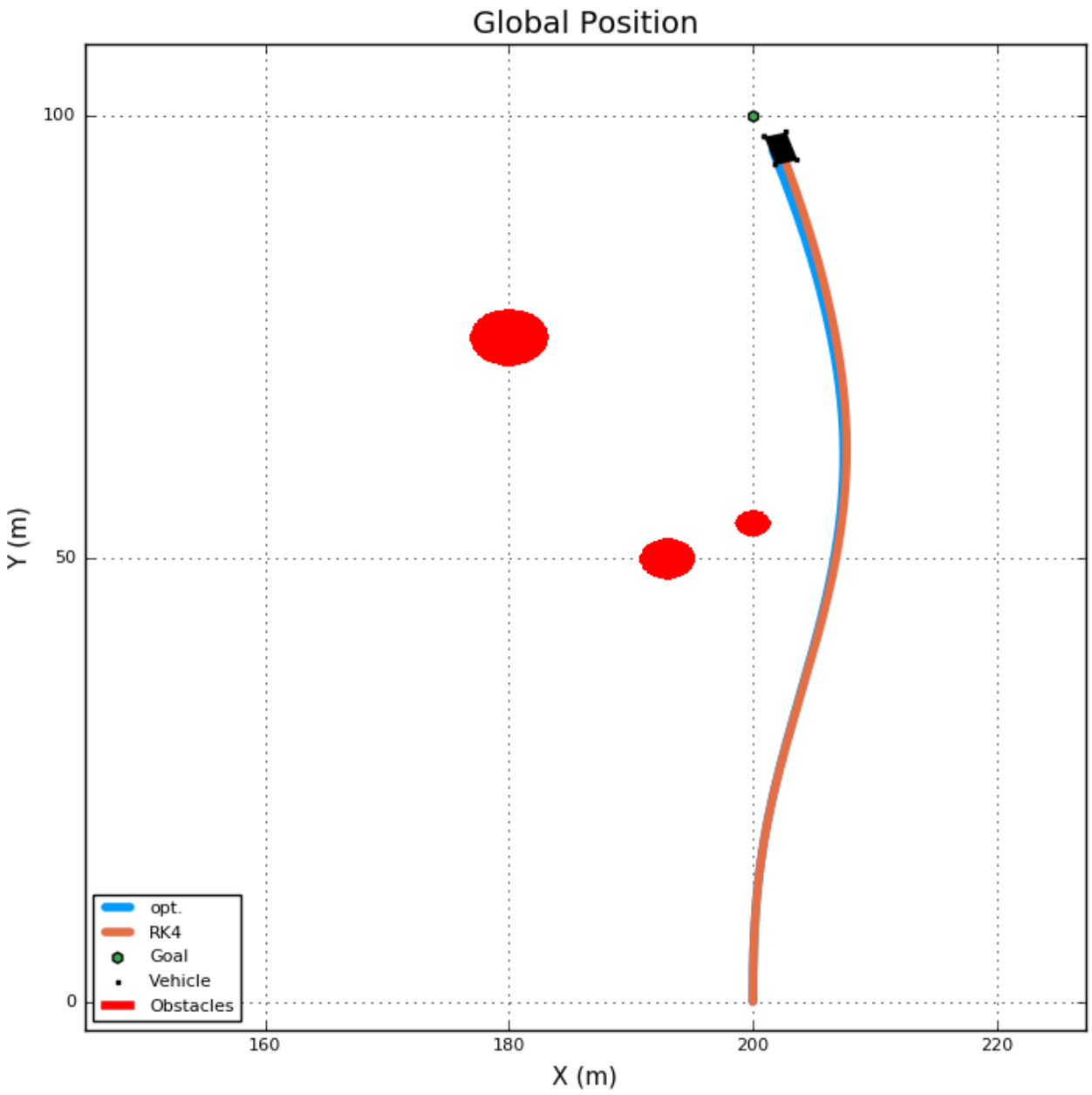

Steering Angle (deg)
20
0
-20
0
5
10
time (s)
min
max
opt.
RK4


6
4
2
0
-2
-4
-6
Steering Rate (deg/s)
0
5
10
time (s)
min
max
opt.
RK4

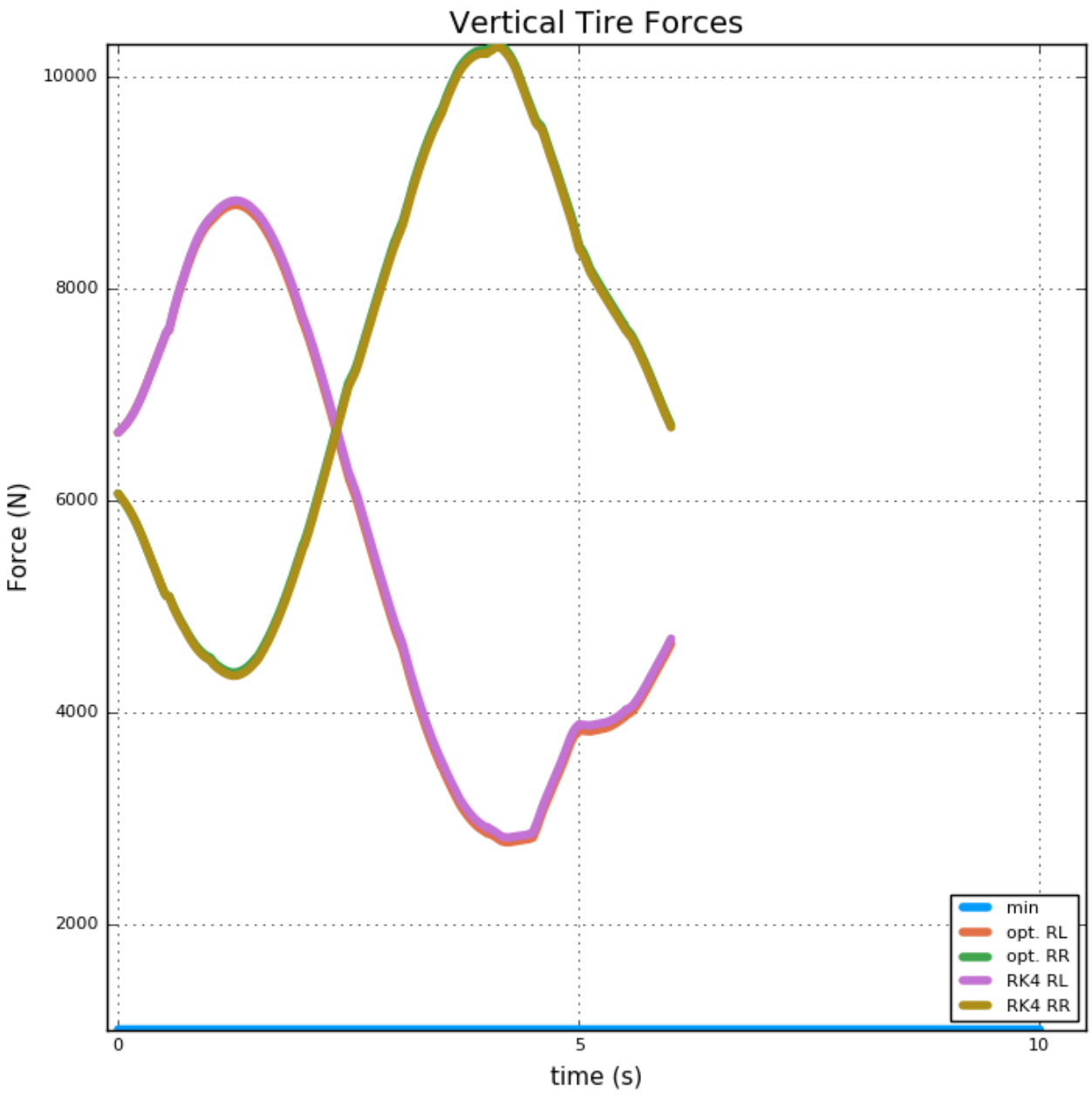

Yaw Angle (deg)
100
90
80
0.0
2.5
5.0
time (s)
opt.
RK4

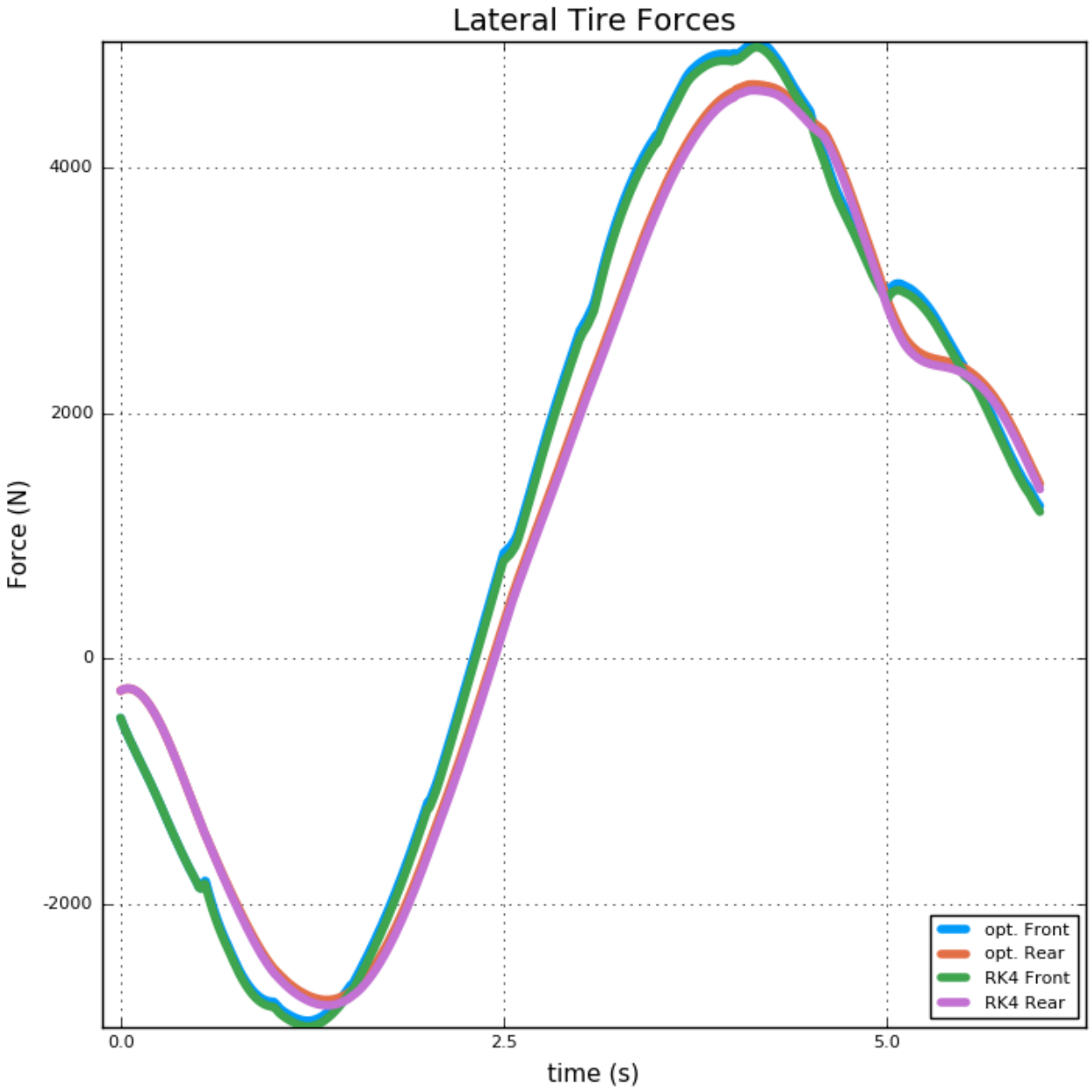

10
5
0
-5
Yaw Rate (deg/s)
0.0
2.5
5.0
time (s)
opt.
RK4


1
0
-1
Lateral Velocity (m/s)
0.0
2.5
5.0
time (s)
opt.
RK4



The tire forces are:


Vertical Tire Forces
Force (N)
time (s)
10000
8000
6000
4000
2000
0
5
10
min
opt. RL
opt. RR
RK4 RL
RK4 RR


Lateral Tire Forces
4000
2000
0
-2000
Force (N)
0.0
2.5
5.0
time (s)
opt. Front
opt. Rear
RK4 Front
RK4 Rear

CHAPTER 3

Tutorial

The examples for this package are available by typing:

```
using IJulia
notebook(dir = Pkg.dir("VehicleModels")*"/examples")
```

Then, the `Three_DOF_ex.ipynb` can be looked at!

CHAPTER 4

Citation

If you find this package useful, please cite this paper (currently in review):

```
@article{Febbo2016,
title = { Moving Obstacle Avoidance for Large, High-Speed Autonomous Ground Vehicles,
author = {Huckleberry Febbo, Jiechao Liu, Paramsothy Jayakumar, Jeffrey L. Stein, and␣
↪Tulga Ersal},
conference = {Dynamic Systems and Control Conference},
year = {2016},
}
```