RTF_Analysis_Sparkle-NoGUI_Nov22

November 22, 2021

[2]:
```
#!/usr/bin/env python

# Author: Rahul Bhadani

import sparkle
import time
import pandas as pd
import numpy as np
import matplotlib.pylab as plt
import bagpy
from bagpy import bagreader
from strym import strymread
import datetime
import time

dt_object = datetime.datetime.fromtimestamp(time.time())
dt = dt_object.strftime('%Y-%m-%d-%H-%M-%S-%f')

# Analysis
cmd_speed =[]
speed = []
posX = []
lead_dist = []
rel_vel = []

bagfiles = []


# no gui sparkle
bagfiles.append('/home/refulgent/Cyverse/sparkle/
 ↪sparkle_n_24_clock_rate_100_clockfactor_0.2_recordtime_400.
 ↪0_2021-11-22-00-48-14.bag')
bagfiles.append('/home/refulgent/Cyverse/sparkle/
 ↪sparkle_n_24_clock_rate_100_clockfactor_0.5_recordtime_400.
 ↪0_2021-11-22-01-04-52.bag')

n_cars = 24
```

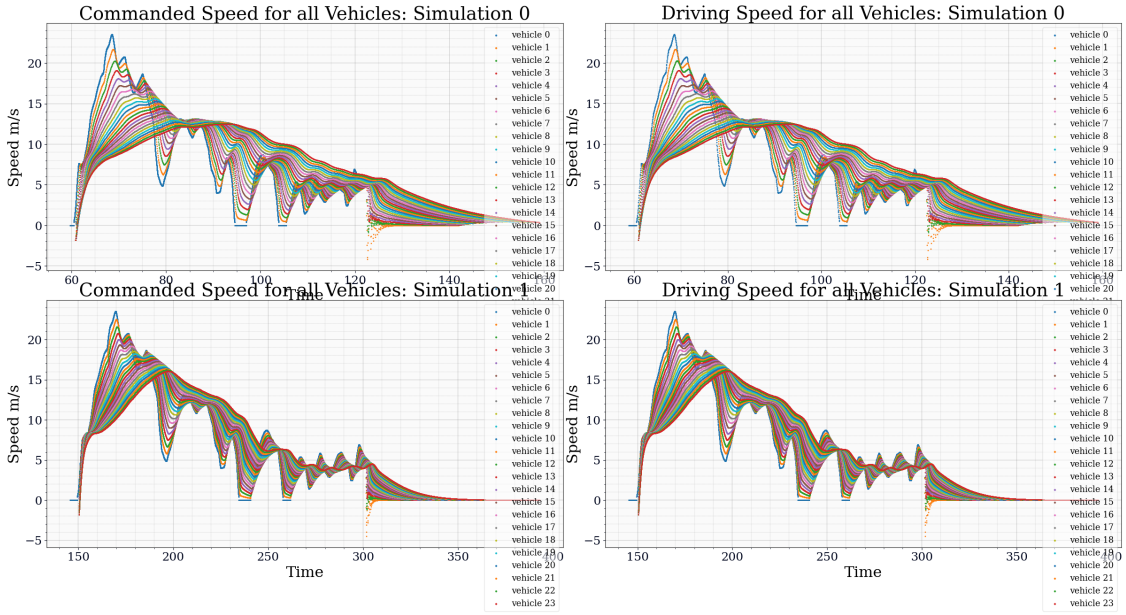
```
Blist = []
for bf in bagfiles:
    B = bagreader(bf)
    Blist.append(B)
    cmd_speed_b = []
    speed_b = []
    odom_b = []
    lead_dist_b = []
    relvel_b = []
    for i in range(0, n_cars):
            # print(i)
            cmdvel_file = B.message_by_topic('/sparkle_{:03d}/cmd_vel'.
 ↪format(i))
            cmdvel = pd.read_csv(cmdvel_file)
            cmd_speed_b.append(cmdvel)

            vel_file = B.message_by_topic('/sparkle_{:03d}/vel'.format(i))
            vel = pd.read_csv(vel_file)
            speed_b.append(vel)

            odom_file = B.message_by_topic('/sparkle_{:03d}/setvel'.format(i))
            odom = pd.read_csv(odom_file)
            odom_b.append(odom)

    cmd_speed.append(cmd_speed_b)
    speed.append(speed_b)
    posX.append(odom_b)
    lead_dist.append(lead_dist_b)
    rel_vel.append(relvel_b)


# per simuation plot
fig, ax = bagpy.create_fig(nrows = len(cmd_speed), ncols = 2 )
ax = ax.reshape(len(cmd_speed), 2 )
for j in range(0, len(cmd_speed)):

    cs = cmd_speed[j]
    s = speed[j]
    ld = lead_dist[j]
    rv = rel_vel[j]

    for i, v in enumerate(cs):
        ax[j, 0].scatter(x = 'Time', y = 'linear.x', data = cs[i], s = 1, label␣
 ↪= 'vehicle {}'.format(i))
        ax[j, 0].legend()
        ax[j, 0].set_xlabel('Time')
        ax[j, 0].set_ylabel('Speed m/s')
```

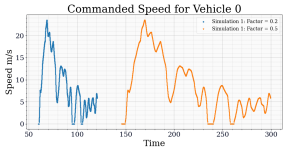
```
        ax[j, 0].set_title('Commanded Speed for all Vehicles: Simulation {}'.
↪format(j))

    for i, v in enumerate(s):
        ax[j, 1].scatter(x = 'Time', y = 'linear.x', data = s[i], s = 1, label␣
↪= 'vehicle {}'.format(i))
        ax[j, 1].legend()
        ax[j, 1].set_xlabel('Time')
        ax[j, 1].set_ylabel('Speed m/s')
        ax[j, 1].set_title('Driving Speed for all Vehicles: Simulation {}'.
↪format(j))

fig.show()
#fig.savefig("persimulationplots_RTFhalf_vs_quarter_{}.png".format(dt), dpi =␣
↪100, bbox_inches='tight')

def scale_time(time_vector, scale = 2.0):
    """

    """
    if scale == 1.0:
        return time_vector
    diff = np.diff(time_vector)
    new_time = []
    new_time.append(time_vector[0])

    for i, d in enumerate(diff):
        t_next = new_time[i]  + d*scale
        new_time.append(t_next)

    return new_time

# overlaid plot
fig, ax = bagpy.create_fig(ncols = 2, nrows = int(np.ceil(n_cars/2)))

# p = [0]
# for k in range(1, len(cmd_speed)):
#     p1 = strymread.time_shift(df1=cmd_speed[0][0], df2=cmd_speed[k][0],␣
↪msg_col1 = 'linear.x', msg_col2='linear.x')
#     p.append(p1)

for j in range(0, len(cmd_speed[0])):

    # print('Vehicle: {}'.format(j))
    p = [0, 0.0]
    #scale = [1.0, 2.0]
    marker = ["o", "v", "s"]
```

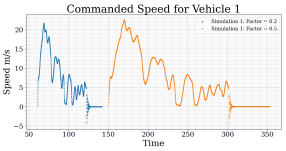
```
    s= [2.0, 2.0, 2.0]
    # lb = [  'Simulation 1: RTF=0.5 MaxupdateRate = 50.0, time_step = 0.01', \
    #         'Simulation 1: RTF=0.25 MaxupdateRate = 25.0, time_step = 0.01',\
    #         'Simulation 1: RTF=0.25 MaxupdateRate = 50.0, time_step = 0.005']

    lb = [  'Simulation 1: Factor = 0.2', \
            'Simulation 1: Factor = 0.5']

    for k in range(0, len(cmd_speed)):

        time = cmd_speed[k][j]['Time'].tolist()
        #new_time = scale_time(time, scale[k])
        #cmd_speed[k][j]['Time'] = new_time
        #ax[j].scatter(x = cmd_speed[k][j]['Time'] - p[k] , y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = 2, label = 'simulation#_{}'.format(k))
        #ax[j].scatter(x= np.arange(0, cmd_speed[k][j].shape[0]) + p[k], y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = s[k], label = lb[k], marker =marker[k])
        ax[j].scatter(x= cmd_speed[k][j]['Time'] + p[k], y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = s[k], label = lb[k], marker =marker[k])


    ax[j].legend()
    ax[j].set_xlabel('Time')
    ax[j].set_ylabel('Speed m/s')
    ax[j].set_title('Commanded Speed for Vehicle {}'.format(j))
    fig.show()


fig, ax = bagpy.create_fig(ncols = 2, nrows = int(np.ceil(n_cars/2)))
for j in range(0, len(cmd_speed[0])):
    p = [0, 0.0]
    marker = ["o", "v", "s"]
    s= [2.0, 2.0, 2.0]
    lb = [  'Simulation 1: Factor = 0.2', \
            'Simulation 1: Factor = 0.5']

    for k in range(0, len(cmd_speed)):

        time = cmd_speed[k][j]['Time'].tolist()
        ax[j].scatter(x= np.arange(0, cmd_speed[k][j].shape[0]) + p[k], y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = s[k], label = lb[k], marker =marker[k])


    ax[j].legend()
    ax[j].set_xlabel('Time')
    ax[j].set_ylabel('Speed m/s')
    ax[j].set_title('Commanded Speed for Vehicle {}'.format(j))
```

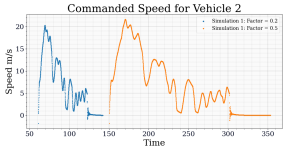
```
    fig.show()
```

```
[INFO]  Data folder /home/refulgent/Cyverse/sparkle/sparkle_n_24_clock_rate_100_
clockfactor_0.2_recordtime_400.0_2021-11-22-00-48-14 already exists. Not
creating.
[INFO]  Data folder /home/refulgent/Cyverse/sparkle/sparkle_n_24_clock_rate_100_
clockfactor_0.5_recordtime_400.0_2021-11-22-01-04-52 already exists. Not
creating.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:88: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:143: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:164: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.
```

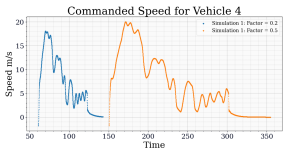


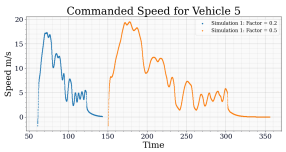

Commanded Speed for Vehicle 0
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

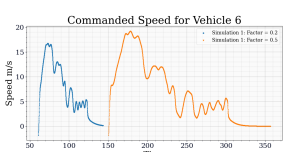

Commanded Speed for Vehicle 1
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

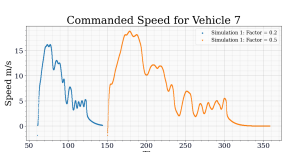

Commanded Speed for Vehicle 2
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

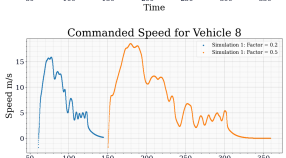

Commanded Speed for Vehicle 3
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

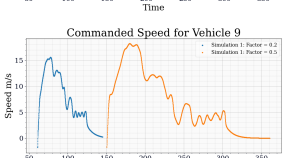

Commanded Speed for Vehicle 4
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

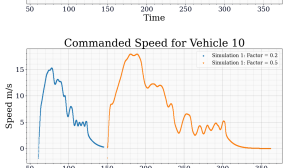

Commanded Speed for Vehicle 5
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

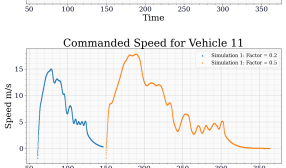

Commanded Speed for Vehicle 6
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 7
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

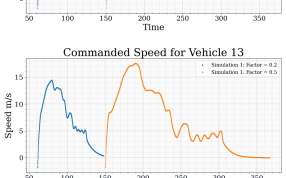

Commanded Speed for Vehicle 8
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

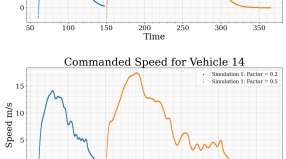

Commanded Speed for Vehicle 9
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 10
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 11
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 12
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 13
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 14
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 15
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 16
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 17
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 18
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

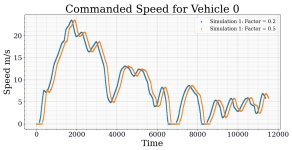

Commanded Speed for Vehicle 19
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

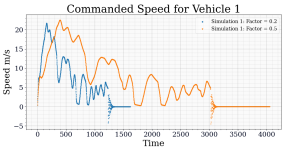

Commanded Speed for Vehicle 20
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

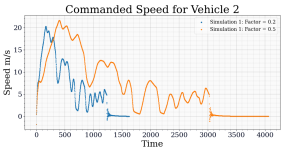

Commanded Speed for Vehicle 21
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

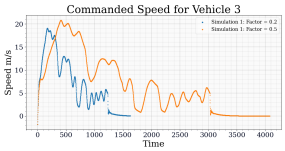

Commanded Speed for Vehicle 22
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

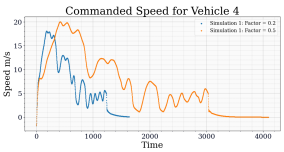

Commanded Speed for Vehicle 23
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

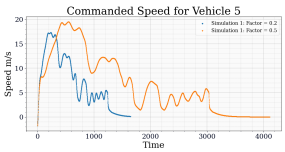

Commanded Speed for Vehicle 0
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

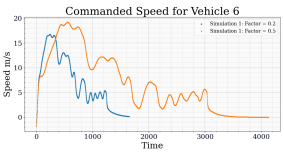

Commanded Speed for Vehicle 1
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

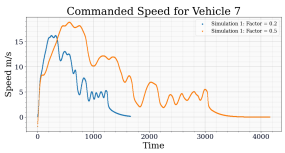

Commanded Speed for Vehicle 2
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

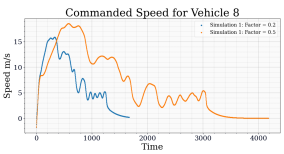

Commanded Speed for Vehicle 3
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

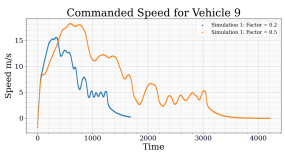

Commanded Speed for Vehicle 4
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

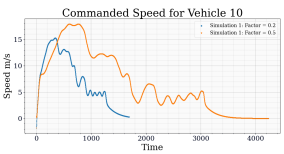

Commanded Speed for Vehicle 5
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

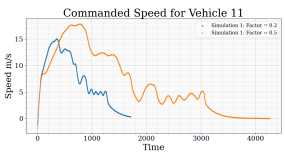

Commanded Speed for Vehicle 6
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

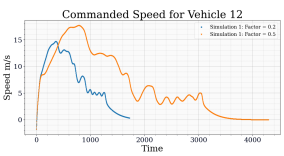

Commanded Speed for Vehicle 7
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

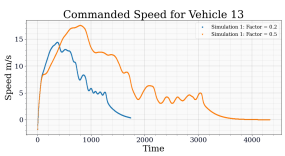

Commanded Speed for Vehicle 8
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

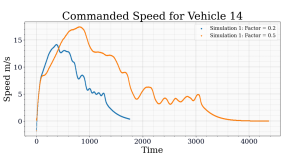

Commanded Speed for Vehicle 9
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

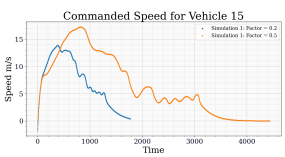

Commanded Speed for Vehicle 10
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

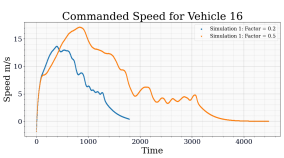

Commanded Speed for Vehicle 11
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

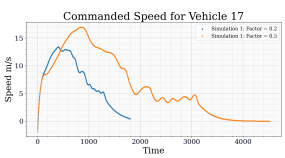

Commanded Speed for Vehicle 12
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

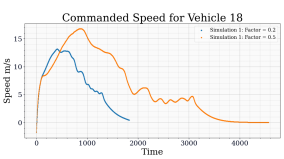

Commanded Speed for Vehicle 13
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

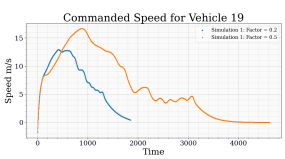

Commanded Speed for Vehicle 14
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

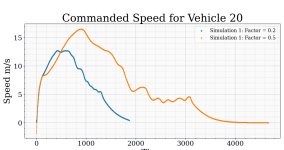

Commanded Speed for Vehicle 15
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

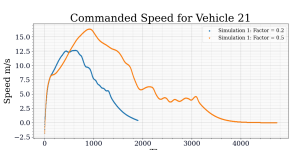

Commanded Speed for Vehicle 16
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

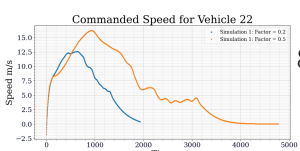

Commanded Speed for Vehicle 17
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

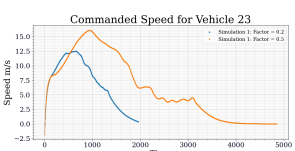

Commanded Speed for Vehicle 18
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 19
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 20
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 21
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 22
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 23
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

[3]:
```
Blist
```

[3]:
```
[<bagpy.bagreader.bagreader at 0x7f6076834750>,
 <bagpy.bagreader.bagreader at 0x7f600aa8ca90>]
```

[4]:
```
B0 = Blist[0]
```

[5]:
```
B0
```

[5]:
```
<bagpy.bagreader.bagreader at 0x7f6076834750>
```

[6]:
```
B0.topic_table
```

[6]:

	Topics	Types	Message Count	Frequency
0	/clock	rosgraph_msgs/Clock	13166	100.000000
1	/rosout	rosgraph_msgs/Log	131962	NaN
2	/rosout_agg	rosgraph_msgs/Log	131973	NaN
3	/sparkle_000/cmd_vel	geometry_msgs/Twist	11376	100.000000
4	/sparkle_000/setvel	nav_msgs/Odometry	2035	33.333333
..	…	…	…	…
71	/sparkle_022/vel	geometry_msgs/Twist	1931	20.000000
72	/sparkle_023/cmd_vel	geometry_msgs/Twist	1965	20.000000
73	/sparkle_023/setvel	nav_msgs/Odometry	1964	20.000000
74	/sparkle_023/vel	geometry_msgs/Twist	1964	20.000000
75	/wall_clock	rosgraph_msgs/Clock	13146	100.000000

[76 rows x 4 columns]

[7]:
```
# Let's calculate the diff of `/clock`
```

[9]:
```
clock_file = B0.message_by_topic('/clock')
clock_df = pd.read_csv(clock_file)
clock_df
```

[9]:

	Time	clock.secs	clock.nsecs
0	28.66	28	360000000
1	28.66	28	370000000
2	28.66	28	380000000
3	28.66	28	390000000
4	28.66	28	400000000
…	…	…	…
13161	159.97	159	970000000
13162	159.98	159	980000000
13163	159.99	159	990000000
13164	160.00	160	0

```
13165  160.01         160     10000000

[13166 rows x 3 columns]
```

[10]:
```
clock_df['Total_Time'] = clock_df['clock.secs'] + clock_df['clock.secs']*1e-9
clock_df
```

[10]:

	Time	clock.secs	clock.nsecs	Total_Time
0	28.66	28	360000000	28.0
1	28.66	28	370000000	28.0
2	28.66	28	380000000	28.0
3	28.66	28	390000000	28.0
4	28.66	28	400000000	28.0
…	…	…	…	…
13161	159.97	159	970000000	159.0
13162	159.98	159	980000000	159.0
13163	159.99	159	990000000	159.0
13164	160.00	160	0	160.0
13165	160.01	160	10000000	160.0

[13166 rows x 4 columns]

[11]:
```
clock_df['Total_Time'].iloc[0]
```

[11]:
```
28.000000028
```

[12]:
```
clock_df['Total_Time'] = clock_df['clock.secs']*1e9 + clock_df['clock.secs']
clock_df
```

[12]:

	Time	clock.secs	clock.nsecs	Total_Time
0	28.66	28	360000000	2.800000e+10
1	28.66	28	370000000	2.800000e+10
2	28.66	28	380000000	2.800000e+10
3	28.66	28	390000000	2.800000e+10
4	28.66	28	400000000	2.800000e+10
…	…	…	…	…
13161	159.97	159	970000000	1.590000e+11
13162	159.98	159	980000000	1.590000e+11
13163	159.99	159	990000000	1.590000e+11
13164	160.00	160	0	1.600000e+11
13165	160.01	160	10000000	1.600000e+11

[13166 rows x 4 columns]

[22]:
```
print("{0:7.10f}".format(2))
```

```
2.0000000000
```

[23]:
```
print("{0:7.18f}".format(2))
```

```
2.000000000000000000
```

[24]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[0]))
```

```
28000000028.000000000000000000
```

[25]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[1]))
```

```
28000000028.000000000000000000
```

[26]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[2]))
```

```
28000000028.000000000000000000
```

[27]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[3]))
```

```
28000000028.000000000000000000
```

[28]:
```
clock_df['Total_Time'] = clock_df['clock.secs']*1e9 + clock_df['clock.secs']
clock_df
```

[28]:

	Time	clock.secs	clock.nsecs	Total_Time
0	28.66	28	360000000	2.800000e+10
1	28.66	28	370000000	2.800000e+10
2	28.66	28	380000000	2.800000e+10
3	28.66	28	390000000	2.800000e+10
4	28.66	28	400000000	2.800000e+10
…	…	…	…	…
13161	159.97	159	970000000	1.590000e+11
13162	159.98	159	980000000	1.590000e+11
13163	159.99	159	990000000	1.590000e+11
13164	160.00	160	0	1.600000e+11
13165	160.01	160	10000000	1.600000e+11

[13166 rows x 4 columns]

[29]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[3]))
```

```
28000000028.000000000000000000
```

[30]:
```
clock_df['Total_Time'] = clock_df['clock.secs']*1e9 + clock_df['clock.nsecs']
clock_df
```

[30]:

	Time	clock.secs	clock.nsecs	Total_Time
0	28.66	28	360000000	2.836000e+10
1	28.66	28	370000000	2.837000e+10

```
2       28.66          28    380000000  2.838000e+10
3       28.66          28    390000000  2.839000e+10
4       28.66          28    400000000  2.840000e+10
…       …         …           …            …
13161  159.97         159    970000000  1.599700e+11
13162  159.98         159    980000000  1.599800e+11
13163  159.99         159    990000000  1.599900e+11
13164  160.00         160            0  1.600000e+11
13165  160.01         160     10000000  1.600100e+11

[13166 rows x 4 columns]
```

[31]:
```
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[3]))
```

```
28390000000.000000000000000000
```

[32]:
```
clock_df['Total_Time'] = clock_df['clock.secs'] + clock_df['clock.nsecs']*1e-9
print("{0:7.18f}".format(clock_df['Total_Time'].iloc[0]))
```

```
28.359999999999999432
```

[33]:
```
clock_df['Total_Time'] = clock_df['clock.secs'] + clock_df['clock.nsecs']*1e-9
clock_df['Tdiff'] =clock_df['Total_Time'].diff()
clock_df
```

[33]:
```
          Time  clock.secs  clock.nsecs  Total_Time  Tdiff
0       28.66          28    360000000       28.36    NaN
1       28.66          28    370000000       28.37   0.01
2       28.66          28    380000000       28.38   0.01
3       28.66          28    390000000       28.39   0.01
4       28.66          28    400000000       28.40   0.01
…       …         …           …          …     …
13161  159.97         159    970000000      159.97   0.01
13162  159.98         159    980000000      159.98   0.01
13163  159.99         159    990000000      159.99   0.01
13164  160.00         160            0      160.00   0.01
13165  160.01         160     10000000      160.01   0.01

[13166 rows x 5 columns]
```

[34]:
```
clock_df
```

[34]:
```
          Time  clock.secs  clock.nsecs  Total_Time  Tdiff
0       28.66          28    360000000       28.36    NaN
1       28.66          28    370000000       28.37   0.01
2       28.66          28    380000000       28.38   0.01
3       28.66          28    390000000       28.39   0.01
```

```
4       28.66          28    400000000       28.40   0.01
…       …         …           …          …     …
13161  159.97         159    970000000      159.97   0.01
13162  159.98         159    980000000      159.98   0.01
13163  159.99         159    990000000      159.99   0.01
13164  160.00         160            0      160.00   0.01
13165  160.01         160     10000000      160.01   0.01

[13166 rows x 5 columns]
```

[35]:
```
print("{0:7.18f}".format(clock_df['Tdiff'].iloc[0]))
```

```
    nan
```

[36]:
```
print("{0:7.18f}".format(clock_df['Tdiff'].iloc[1]))
```

```
0.010000000000001563
```

[38]:
```
B0 = Blist[0]
clock_file = B0.message_by_topic('/clock')
clock_df1 = pd.read_csv(clock_file)
clock_df1['Total_Time'] = clock_df1['clock.secs'] + clock_df1['clock.
 ↪nsecs']*1e-9
clock_df1['Tdiff'] =clock_df1['Total_Time'].diff()

B1 = Blist[1]
clock_file = B1.message_by_topic('/clock')
clock_df2 = pd.read_csv(clock_file)
clock_df2['Total_Time'] = clock_df2['clock.secs'] + clock_df2['clock.
 ↪nsecs']*1e-9
clock_df2['Tdiff'] =clock_df2['Total_Time'].diff()
```

[39]:
```
clock_df1
```

[39]:
```
          Time  clock.secs  clock.nsecs  Total_Time  Tdiff
0       28.66          28    360000000       28.36    NaN
1       28.66          28    370000000       28.37   0.01
2       28.66          28    380000000       28.38   0.01
3       28.66          28    390000000       28.39   0.01
4       28.66          28    400000000       28.40   0.01
…       …         …           …          …     …
13161  159.97         159    970000000      159.97   0.01
13162  159.98         159    980000000      159.98   0.01
13163  159.99         159    990000000      159.99   0.01
13164  160.00         160            0      160.00   0.01
13165  160.01         160     10000000      160.01   0.01
```

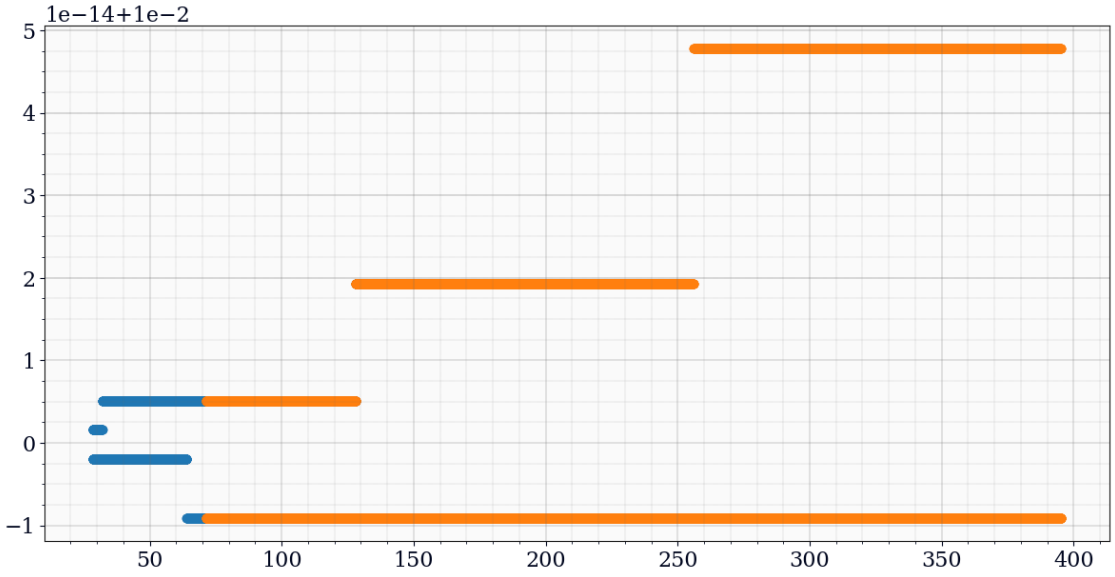
```
[13166 rows x 5 columns]
```

[40]:
```
clock_df2
```

[40]:
```
          Time  clock.secs  clock.nsecs  Total_Time  Tdiff
0        71.58          70    770000000       70.77    NaN
1        71.58          70    780000000       70.78   0.01
2        71.58          70    790000000       70.79   0.01
3        71.58          70    800000000       70.80   0.01
4        71.58          70    810000000       70.81   0.01
…          …          …           …          …      …
32444   395.21         395    210000000      395.21   0.01
32445   395.22         395    220000000      395.22   0.01
32446   395.23         395    230000000      395.23   0.01
32447   395.24         395    240000000      395.24   0.01
32448   395.25         395    250000000      395.25   0.01

[32449 rows x 5 columns]
```

[41]:
```
fig, ax = bagpy.create_fig(1)
ax[0].scatter(x = 'Time', y = 'Tdiff', data = clock_df1)

ax[0].scatter(x = 'Time', y = 'Tdiff', data = clock_df2)
```

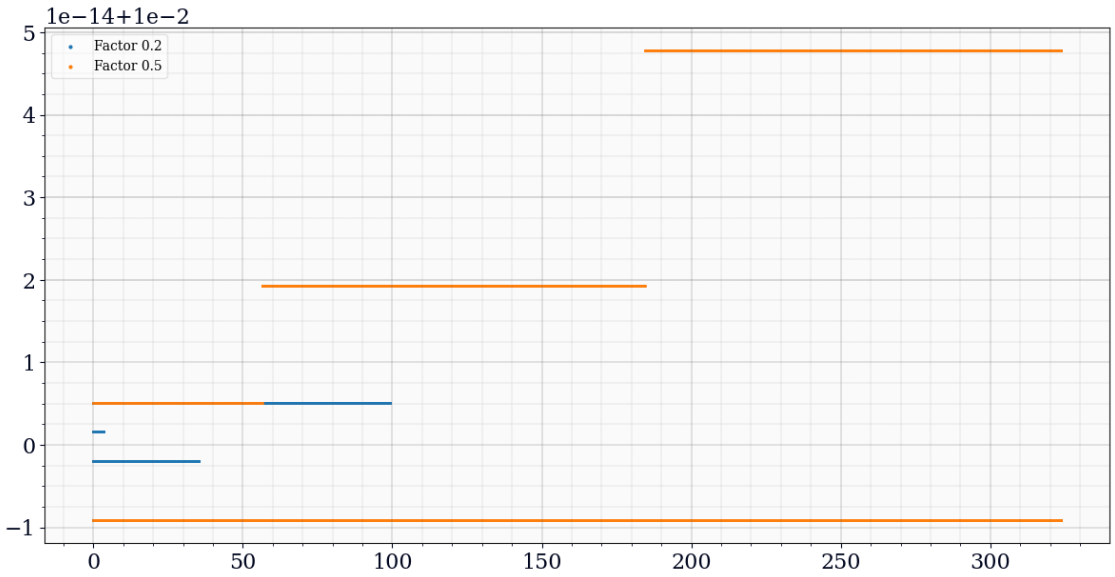
[41]:
```
<matplotlib.collections.PathCollection at 0x7f5fee9ec950>
```



[43]:
```
fig, ax = bagpy.create_fig(1)
```

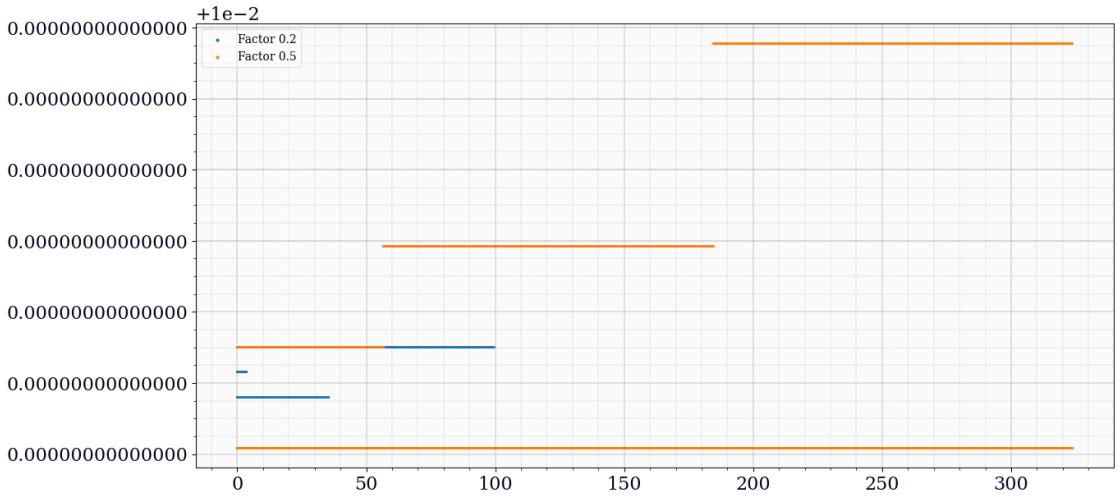
```
ax[0].scatter(x = clock_df1['Time'] - clock_df1['Time'].iloc[0], y =␣
 ↪clock_df1['Tdiff'], label='Factor 0.2', s= 1)

ax[0].scatter(x = clock_df2['Time'] - clock_df2['Time'].iloc[0], y =␣
 ↪clock_df2['Tdiff'], label='Factor 0.5', s= 1)
ax[0].legend()
```

[43]: <matplotlib.legend.Legend at 0x7f5fee76ca50>



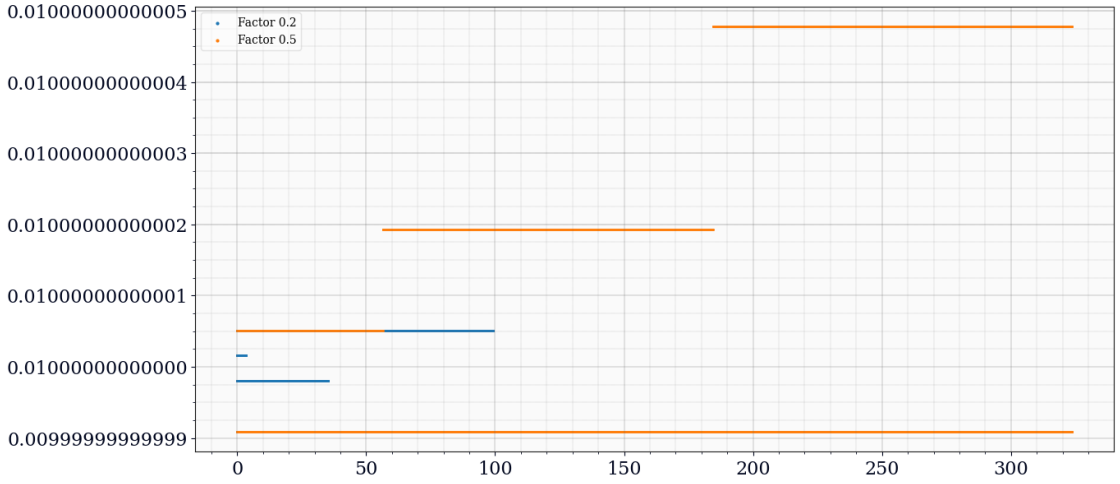
[44]:
```
fig, ax = bagpy.create_fig(1)
ax[0].scatter(x = clock_df1['Time'] - clock_df1['Time'].iloc[0], y =␣
 ↪clock_df1['Tdiff'], label='Factor 0.2', s= 1)

ax[0].scatter(x = clock_df2['Time'] - clock_df2['Time'].iloc[0], y =␣
 ↪clock_df2['Tdiff'], label='Factor 0.5', s= 1)
plt.ticklabel_format(style='plain')
ax[0].legend()
```

[44]: <matplotlib.legend.Legend at 0x7f5fee9be710>



[46]:
```
fig, ax = bagpy.create_fig(1)
ax[0].scatter(x = clock_df1['Time'] - clock_df1['Time'].iloc[0], y =␣
↪clock_df1['Tdiff'], label='Factor 0.2', s= 1)

ax[0].scatter(x = clock_df2['Time'] - clock_df2['Time'].iloc[0], y =␣
↪clock_df2['Tdiff'], label='Factor 0.5', s= 1)
ax[0].ticklabel_format(useOffset=False)
ax[0].legend()
```

[46]:
```
<matplotlib.legend.Legend at 0x7f5fee5d7190>
```



[47]:
```
cmd_speed
```

```
[47]: [[         Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
       0        59.72      0.00       0.0       0.0        0.0        0.0        0.0
       1        59.72      0.00       0.0       0.0        0.0        0.0        0.0
       2        59.73      0.00       0.0       0.0        0.0        0.0        0.0
       3        59.74      0.00       0.0       0.0        0.0        0.0        0.0
       4        59.74      0.00       0.0       0.0        0.0        0.0        0.0
       …         …         …          …         …          …          …          …
       11371   120.54      5.87       0.0       0.0        0.0        0.0        0.0
       11372   120.55      5.85       0.0       0.0        0.0        0.0        0.0
       11373   120.56      5.85       0.0       0.0        0.0        0.0        0.0
       11374   120.57      5.84       0.0       0.0        0.0        0.0        0.0
       11375   120.57      5.84       0.0       0.0        0.0        0.0        0.0

       [11376 rows x 7 columns],
              Time      linear.x  linear.y      linear.z  angular.x  angular.y  \
       0      60.83  4.500000e-01       0.0  7.500000e-01        0.0        0.0
       1      60.88  4.500000e-01       0.0  7.500000e-01        0.0        0.0
       2      60.93  1.045863e+00       0.0  9.931046e-01        0.0        0.0
       3      60.98  1.583952e+00       0.0  8.968163e-01        0.0        0.0
       4      61.03  2.132339e+00       0.0  9.139771e-01        0.0        0.0
       …       …           …         …           …          …          …
       1619  141.78  1.487683e-06       0.0  8.821487e-06        0.0        0.0
       1620  141.83  6.279896e-06       0.0  7.987022e-06        0.0        0.0
       1621  141.88  6.673287e-06       0.0  6.556511e-07        0.0        0.0
       1622  141.93 -9.441865e-07       0.0 -1.269579e-05        0.0        0.0
       1623  141.98 -7.774879e-06       0.0 -1.138449e-05        0.0        0.0

             angular.z
       0           0.0
       1           0.0
       2           0.0
       3           0.0
       4           0.0
       …           …
       1619        0.0
       1620        0.0
       1621        0.0
       1622        0.0
       1623        0.0

       [1624 rows x 7 columns],
              Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
       0      60.85 -1.799905       0.0 -2.999842        0.0        0.0        0.0
       1      60.90  0.450000       0.0  0.750000        0.0        0.0        0.0
       2      60.95  0.748849       0.0  0.498081        0.0        0.0        0.0
       3      61.00  0.989103       0.0  0.400425        0.0        0.0        0.0
       4      61.05  1.372568       0.0  0.639108        0.0        0.0        0.0
```

```
…      …       …       …       …         …        …        …
1622  141.95  0.026193       0.0 -0.000309       0.0      0.0      0.0
1623  142.00  0.026006       0.0 -0.000312       0.0      0.0      0.0
1624  142.05  0.025820       0.0 -0.000309       0.0      0.0      0.0
1625  142.10  0.025637       0.0 -0.000306       0.0      0.0      0.0
1626  142.15  0.025455       0.0 -0.000304       0.0      0.0      0.0

[1627 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.85 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.90 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.95 -1.206457       0.0  0.989081        0.0        0.0        0.0
3      61.00 -0.659779       0.0  0.911130        0.0        0.0        0.0
4      61.05 -0.164411       0.0  0.825614        0.0        0.0        0.0
…      …       …       …       …         …        …        …
1628  142.25  0.056147       0.0 -0.000649       0.0      0.0      0.0
1629  142.30  0.055758       0.0 -0.000648       0.0      0.0      0.0
1630  142.35  0.055371       0.0 -0.000646       0.0      0.0      0.0
1631  142.40  0.054985       0.0 -0.000643       0.0      0.0      0.0
1632  142.45  0.054601       0.0 -0.000640       0.0      0.0      0.0

[1633 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.86 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.91 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.96 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      61.01 -1.265367       0.0  0.490589        0.0        0.0        0.0
4      61.06 -0.933920       0.0  0.552413        0.0        0.0        0.0
…      …       …       …       …         …        …        …
1634  142.56  0.087113       0.0 -0.000983       0.0      0.0      0.0
1635  142.61  0.086521       0.0 -0.000986       0.0      0.0      0.0
1636  142.66  0.085929       0.0 -0.000987       0.0      0.0      0.0
1637  142.71  0.085338       0.0 -0.000986       0.0      0.0      0.0
1638  142.76  0.084748       0.0 -0.000984       0.0      0.0      0.0

[1639 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.82 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.87 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.92 -1.349905       0.0  0.750000        0.0        0.0        0.0
3      60.97 -1.191614       0.0  0.263818        0.0        0.0        0.0
4      61.02 -1.023372       0.0  0.280404        0.0        0.0        0.0
…      …       …       …       …         …        …        …
1642  142.92  0.119461       0.0 -0.001341       0.0      0.0      0.0
1643  142.97  0.118653       0.0 -0.001346       0.0      0.0      0.0
1644  143.02  0.117844       0.0 -0.001348       0.0      0.0      0.0
1645  143.07  0.117035       0.0 -0.001348       0.0      0.0      0.0
```

```
1646  143.12  0.116228       0.0 -0.001346        0.0        0.0        0.0

[1647 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.82 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.87 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.92 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.97 -1.289075       0.0  0.451075        0.0        0.0        0.0
4      61.02 -1.041799       0.0  0.412127        0.0        0.0        0.0
…       …       …        …        …         …         …         …
1650  143.32  0.153235       0.0 -0.001726        0.0        0.0        0.0
1651  143.37  0.152196       0.0 -0.001732        0.0        0.0        0.0
1652  143.42  0.151156       0.0 -0.001733        0.0        0.0        0.0
1653  143.47  0.150116       0.0 -0.001732        0.0        0.0        0.0
1654  143.52  0.149079       0.0 -0.001729        0.0        0.0        0.0

[1655 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89  0.450000       0.0  0.750000        0.0        0.0        0.0
2      60.94  0.247598       0.0 -0.337337        0.0        0.0        0.0
3      60.99  0.169591       0.0 -0.130011        0.0        0.0        0.0
4      61.04  0.148754       0.0 -0.034729        0.0        0.0        0.0
…       …       …        …        …         …         …         …
1659  143.79  0.186785       0.0 -0.002130        0.0        0.0        0.0
1660  143.84  0.185506       0.0 -0.002131        0.0        0.0        0.0
1661  143.89  0.184229       0.0 -0.002129        0.0        0.0        0.0
1662  143.94  0.182955       0.0 -0.002124        0.0        0.0        0.0
1663  143.99  0.181684       0.0 -0.002117        0.0        0.0        0.0

[1664 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.85 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.90 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.95 -1.206457       0.0  0.989081        0.0        0.0        0.0
3      61.00 -0.737053       0.0  0.782340        0.0        0.0        0.0
4      61.05 -0.360281       0.0  0.627953        0.0        0.0        0.0
…       …       …        …        …         …         …         …
1667  144.20  0.224114       0.0 -0.002521        0.0        0.0        0.0
1668  144.25  0.222596       0.0 -0.002529        0.0        0.0        0.0
1669  144.30  0.221077       0.0 -0.002532        0.0        0.0        0.0
1670  144.35  0.219559       0.0 -0.002531        0.0        0.0        0.0
1671  144.40  0.218043       0.0 -0.002526        0.0        0.0        0.0

[1672 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.86 -1.799905       0.0 -2.999842        0.0        0.0        0.0
```

```
1      60.91 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.96 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      61.01 -1.265367       0.0  0.490589        0.0        0.0        0.0
4      61.06 -0.946641       0.0  0.531211        0.0        0.0        0.0
…      …       …       …       …        …        …        …
1678  144.76  0.257955       0.0 -0.002963        0.0        0.0        0.0
1679  144.81  0.256179       0.0 -0.002960        0.0        0.0        0.0
1680  144.86  0.254407       0.0 -0.002953        0.0        0.0        0.0
1681  144.91  0.252641       0.0 -0.002943        0.0        0.0        0.0
1682  144.96  0.250882       0.0 -0.002932        0.0        0.0        0.0

[1683 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.86 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.91 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.96 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      61.01 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.06 -1.082859       0.0  0.401872        0.0        0.0        0.0
…      …       …       …       …        …        …        …
1690  145.36  0.290325       0.0 -0.003362        0.0        0.0        0.0
1691  145.41  0.288314       0.0 -0.003352        0.0        0.0        0.0
1692  145.46  0.286310       0.0 -0.003340        0.0        0.0        0.0
1693  145.51  0.284314       0.0 -0.003326        0.0        0.0        0.0
1694  145.56  0.282329       0.0 -0.003309        0.0        0.0        0.0

[1695 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.83 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.88 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.93 -1.349905       0.0  0.750000        0.0        0.0        0.0
3      60.98 -1.191614       0.0  0.263818        0.0        0.0        0.0
4      61.03 -0.985558       0.0  0.343427        0.0        0.0        0.0
…      …       …       …       …        …        …        …
1704  146.03  0.319086       0.0 -0.003722        0.0        0.0        0.0
1705  146.08  0.316863       0.0 -0.003705        0.0        0.0        0.0
1706  146.13  0.314650       0.0 -0.003687        0.0        0.0        0.0
1707  146.18  0.312450       0.0 -0.003667        0.0        0.0        0.0
1708  146.23  0.310263       0.0 -0.003646        0.0        0.0        0.0

[1709 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.94 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.99 -1.289075       0.0  0.451075        0.0        0.0        0.0
4      61.04 -1.041799       0.0  0.412127        0.0        0.0        0.0
…      …       …       …       …        …        …        …
```

```
1720  146.84  0.342013       0.0 -0.004011        0.0        0.0        0.0
1721  146.89  0.339620       0.0 -0.003988        0.0        0.0        0.0
1722  146.94  0.337242       0.0 -0.003964        0.0        0.0        0.0
1723  146.99  0.334878       0.0 -0.003940        0.0        0.0        0.0
1724  147.04  0.332529       0.0 -0.003914        0.0        0.0        0.0

[1725 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.94 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.99 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.04 -1.086838       0.0  0.395240        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1735  147.59  0.366797       0.0 -0.004296        0.0        0.0        0.0
1736  147.64  0.364233       0.0 -0.004273        0.0        0.0        0.0
1737  147.69  0.361684       0.0 -0.004248        0.0        0.0        0.0
1738  147.74  0.359151       0.0 -0.004222        0.0        0.0        0.0
1739  147.79  0.356633       0.0 -0.004196        0.0        0.0        0.0

[1740 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.94 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.99 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.04 -1.092703       0.0  0.385466        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1750  148.34  0.391076       0.0 -0.004578        0.0        0.0        0.0
1751  148.39  0.388344       0.0 -0.004554        0.0        0.0        0.0
1752  148.44  0.385627       0.0 -0.004527        0.0        0.0        0.0
1753  148.49  0.382927       0.0 -0.004500        0.0        0.0        0.0
1754  148.54  0.380245       0.0 -0.004471        0.0        0.0        0.0

[1755 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.94 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.99 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.04 -1.092703       0.0  0.385466        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1768  149.24  0.406242       0.0 -0.004772        0.0        0.0        0.0
1769  149.29  0.403397       0.0 -0.004742        0.0        0.0        0.0
1770  149.34  0.400570       0.0 -0.004711        0.0        0.0        0.0
1771  149.39  0.397762       0.0 -0.004680        0.0        0.0        0.0
1772  149.44  0.394973       0.0 -0.004648        0.0        0.0        0.0
```

```
[1773 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.86 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.91 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.96 -1.522504       0.0  0.462335        0.0        0.0        0.0
3      61.01 -1.256535       0.0  0.443283        0.0        0.0        0.0
4      61.06 -1.037973       0.0  0.364271        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1785  150.11  0.421806       0.0 -0.004962        0.0        0.0        0.0
1786  150.16  0.418849       0.0 -0.004929        0.0        0.0        0.0
1787  150.21  0.415911       0.0 -0.004896        0.0        0.0        0.0
1788  150.26  0.412994       0.0 -0.004862        0.0        0.0        0.0
1789  150.31  0.410097       0.0 -0.004829        0.0        0.0        0.0

[1790 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.82 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.87 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.92 -1.349830       0.0  0.750126        0.0        0.0        0.0
3      60.97 -1.191553       0.0  0.263794        0.0        0.0        0.0
4      61.02 -1.016986       0.0  0.290945        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1803  150.97  0.438683       0.0 -0.005149        0.0        0.0        0.0
1804  151.02  0.435613       0.0 -0.005117        0.0        0.0        0.0
1805  151.07  0.432563       0.0 -0.005084        0.0        0.0        0.0
1806  151.12  0.429532       0.0 -0.005051        0.0        0.0        0.0
1807  151.17  0.426523       0.0 -0.005016        0.0        0.0        0.0

[1808 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.83 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.88 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.93 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.98 -1.289063       0.0  0.451096        0.0        0.0        0.0
4      61.03 -1.041778       0.0  0.412141        0.0        0.0        0.0
…       …        …        …        …         …         …         …
1824  152.03  0.442397       0.0 -0.005201        0.0        0.0        0.0
1825  152.08  0.439298       0.0 -0.005165        0.0        0.0        0.0
1826  152.13  0.436220       0.0 -0.005130        0.0        0.0        0.0
1827  152.18  0.433164       0.0 -0.005094        0.0        0.0        0.0
1828  152.23  0.430130       0.0 -0.005057        0.0        0.0        0.0

[1829 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.83 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.88 -1.799905       0.0 -2.999842        0.0        0.0        0.0
```

```
2      60.93 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.98 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.03 -1.086836       0.0  0.395244        0.0        0.0        0.0
…       …       …       …       …        …        …        …
1847  153.18  0.439683       0.0 -0.005179        0.0        0.0        0.0
1848  153.23  0.436598       0.0 -0.005141        0.0        0.0        0.0
1849  153.28  0.433536       0.0 -0.005103        0.0        0.0        0.0
1850  153.33  0.430497       0.0 -0.005066        0.0        0.0        0.0
1851  153.38  0.427480       0.0 -0.005028        0.0        0.0        0.0

[1852 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.85 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.90  0.499820       0.0  0.833033        0.0        0.0        0.0
2      60.95  0.326378       0.0 -0.289069        0.0        0.0        0.0
3      61.00  0.187158       0.0 -0.232034        0.0        0.0        0.0
4      61.05  0.154539       0.0 -0.054365        0.0        0.0        0.0
…       …       …       …       …        …        …        …
1870  154.35  0.435086       0.0 -0.005118        0.0        0.0        0.0
1871  154.40  0.432037       0.0 -0.005081        0.0        0.0        0.0
1872  154.45  0.429011       0.0 -0.005044        0.0        0.0        0.0
1873  154.50  0.426006       0.0 -0.005008        0.0        0.0        0.0
1874  154.55  0.423023       0.0 -0.004972        0.0        0.0        0.0

[1875 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.82 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.87 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.92 -1.199194       0.0  1.001186        0.0        0.0        0.0
3      60.97 -0.692312       0.0  0.844803        0.0        0.0        0.0
4      61.02 -0.298202       0.0  0.656850        0.0        0.0        0.0
…       …       …       …       …        …        …        …
1897  155.67  0.421967       0.0 -0.004977        0.0        0.0        0.0
1898  155.72  0.419004       0.0 -0.004938        0.0        0.0        0.0
1899  155.77  0.416065       0.0 -0.004899        0.0        0.0        0.0
1900  155.82  0.413147       0.0 -0.004862        0.0        0.0        0.0
1901  155.87  0.410252       0.0 -0.004825        0.0        0.0        0.0

[1902 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.83 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.88 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.93 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.98 -1.264170       0.0  0.492583        0.0        0.0        0.0
4      61.03 -0.938280       0.0  0.543151        0.0        0.0        0.0
…       …       …       …       …        …        …        …
1927  157.18  0.400123       0.0 -0.004708        0.0        0.0        0.0
```

```
1928  157.23  0.397320       0.0 -0.004672        0.0        0.0        0.0
1929  157.28  0.394538       0.0 -0.004637        0.0        0.0        0.0
1930  157.33  0.391776       0.0 -0.004602        0.0        0.0        0.0
1931  157.38  0.389036       0.0 -0.004568        0.0        0.0        0.0

[1932 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      60.84 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1      60.89 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2      60.94 -1.559721       0.0  0.400308        0.0        0.0        0.0
3      60.99 -1.323982       0.0  0.392897        0.0        0.0        0.0
4      61.04 -1.082658       0.0  0.402206        0.0        0.0        0.0
…       …       …        …        …         …         …         …
1960  158.84  0.372543       0.0 -0.004381        0.0        0.0        0.0
1961  158.89  0.369934       0.0 -0.004348        0.0        0.0        0.0
1962  158.94  0.367345       0.0 -0.004316        0.0        0.0        0.0
1963  158.99  0.364775       0.0 -0.004283        0.0        0.0        0.0
1964  159.04  0.362224       0.0 -0.004251        0.0        0.0        0.0

[1965 rows x 7 columns]],
[         Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0      145.72      0.00       0.0       0.0        0.0        0.0        0.0
1      145.73      0.00       0.0       0.0        0.0        0.0        0.0
2      145.74      0.00       0.0       0.0        0.0        0.0        0.0
3      145.75      0.00       0.0       0.0        0.0        0.0        0.0
4      145.77      0.00       0.0       0.0        0.0        0.0        0.0
…       …       …        …        …         …         …         …
11526  299.62      5.87       0.0       0.0        0.0        0.0        0.0
11527  299.65      5.85       0.0       0.0        0.0        0.0        0.0
11528  299.66      5.85       0.0       0.0        0.0        0.0        0.0
11529  299.68      5.84       0.0       0.0        0.0        0.0        0.0
11530  299.68      5.84       0.0       0.0        0.0        0.0        0.0

[11531 rows x 7 columns],
        Time      linear.x  linear.y      linear.z  angular.x  angular.y  \
0     150.32  4.500000e-01       0.0  7.500000e-01        0.0        0.0
1     150.37  4.500000e-01       0.0  7.500000e-01        0.0        0.0
2     150.42  9.713300e-01       0.0  8.688834e-01        0.0        0.0
3     150.47  1.437048e+00       0.0  7.761968e-01        0.0        0.0
4     150.52  1.827699e+00       0.0  6.510851e-01        0.0        0.0
…      …           …       …           …         …         …
4054  353.02 -5.464302e-07       0.0  8.344650e-07        0.0        0.0
4055  353.07 -8.151399e-08       0.0  7.748604e-07        0.0        0.0
4056  353.12  3.118767e-07       0.0  6.556511e-07        0.0        0.0
4057  353.17  7.052673e-07       0.0  6.556511e-07        0.0        0.0
4058  353.22  1.098658e-06       0.0  6.556511e-07        0.0        0.0
```

```
      angular.z
0           0.0
1           0.0
2           0.0
3           0.0
4           0.0
…         …
4054        0.0
4055        0.0
4056        0.0
4057        0.0
4058        0.0

[4059 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39  0.450000       0.0  0.750000        0.0        0.0        0.0
2     150.44  0.736041       0.0  0.476735        0.0        0.0        0.0
3     150.49  1.047951       0.0  0.519850        0.0        0.0        0.0
4     150.54  1.368055       0.0  0.533507        0.0        0.0        0.0
…      …        …        …        …         …         …         …
4061  353.39  0.000319       0.0 -0.000004        0.0        0.0        0.0
4062  353.44  0.000317       0.0 -0.000004        0.0        0.0        0.0
4063  353.49  0.000314       0.0 -0.000004        0.0        0.0        0.0
4064  353.54  0.000312       0.0 -0.000004        0.0        0.0        0.0
4065  353.59  0.000310       0.0 -0.000004        0.0        0.0        0.0

[4066 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.44 -1.206457       0.0  0.989081        0.0        0.0        0.0
3     150.49 -0.661720       0.0  0.907896        0.0        0.0        0.0
4     150.54 -0.156833       0.0  0.841478        0.0        0.0        0.0
…      …        …        …        …         …         …         …
4075  354.09  0.000705       0.0 -0.000008        0.0        0.0        0.0
4076  354.14  0.000700       0.0 -0.000008        0.0        0.0        0.0
4077  354.19  0.000695       0.0 -0.000008        0.0        0.0        0.0
4078  354.24  0.000690       0.0 -0.000008        0.0        0.0        0.0
4079  354.29  0.000685       0.0 -0.000008        0.0        0.0        0.0

[4080 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.44 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.49 -1.265367       0.0  0.490589        0.0        0.0        0.0
```

```
4     150.54 -0.934238       0.0  0.551881        0.0        0.0        0.0
…      …       …        …       …         …        …        …
4091  354.89  0.001144       0.0 -0.000013        0.0        0.0        0.0
4092  354.94  0.001136       0.0 -0.000013        0.0        0.0        0.0
4093  354.99  0.001128       0.0 -0.000013        0.0        0.0        0.0
4094  355.04  0.001120       0.0 -0.000013        0.0        0.0        0.0
4095  355.09  0.001112       0.0 -0.000013        0.0        0.0        0.0

[4096 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.44 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.49 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.54 -1.082859       0.0  0.401872        0.0        0.0        0.0
…      …       …        …       …         …        …        …
4107  355.69  0.001646       0.0 -0.000019        0.0        0.0        0.0
4108  355.74  0.001634       0.0 -0.000019        0.0        0.0        0.0
4109  355.79  0.001623       0.0 -0.000019        0.0        0.0        0.0
4110  355.84  0.001612       0.0 -0.000019        0.0        0.0        0.0
4111  355.89  0.001600       0.0 -0.000019        0.0        0.0        0.0

[4112 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.44 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.49 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.54 -1.092703       0.0  0.385466        0.0        0.0        0.0
…      …       …        …       …         …        …        …
4128  356.74  0.002138       0.0 -0.000025        0.0        0.0        0.0
4129  356.79  0.002123       0.0 -0.000025        0.0        0.0        0.0
4130  356.84  0.002108       0.0 -0.000025        0.0        0.0        0.0
4131  356.89  0.002093       0.0 -0.000025        0.0        0.0        0.0
4132  356.94  0.002078       0.0 -0.000025        0.0        0.0        0.0

[4133 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.30 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.35 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.40 -1.349905       0.0  0.750000        0.0        0.0        0.0
3     150.45 -1.191614       0.0  0.263818        0.0        0.0        0.0
4     150.50 -1.023372       0.0  0.280404        0.0        0.0        0.0
…      …       …        …       …         …        …        …
4154  358.00  0.002584       0.0 -0.000031        0.0        0.0        0.0
4155  358.05  0.002566       0.0 -0.000030        0.0        0.0        0.0
4156  358.10  0.002548       0.0 -0.000030        0.0        0.0        0.0
```

```
4157  358.15  0.002530       0.0 -0.000030        0.0        0.0        0.0
4158  358.20  0.002512       0.0 -0.000030        0.0        0.0        0.0

[4159 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.30 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.35 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.40 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.45 -1.289075       0.0  0.451075        0.0        0.0        0.0
4     150.50 -1.041799       0.0  0.412127        0.0        0.0        0.0
…      …        …        …        …         …         …         …
4176  359.10  0.003096       0.0 -0.000037        0.0        0.0        0.0
4177  359.15  0.003074       0.0 -0.000036        0.0        0.0        0.0
4178  359.20  0.003052       0.0 -0.000036        0.0        0.0        0.0
4179  359.25  0.003031       0.0 -0.000036        0.0        0.0        0.0
4180  359.30  0.003009       0.0 -0.000036        0.0        0.0        0.0

[4181 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.30 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.35 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.40 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.45 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.50 -1.086838       0.0  0.395240        0.0        0.0        0.0
…      …        …        …        …         …         …         …
4204  360.50  0.003469       0.0 -0.000041        0.0        0.0        0.0
4205  360.55  0.003445       0.0 -0.000040        0.0        0.0        0.0
4206  360.60  0.003421       0.0 -0.000040        0.0        0.0        0.0
4207  360.65  0.003396       0.0 -0.000040        0.0        0.0        0.0
4208  360.70  0.003372       0.0 -0.000040        0.0        0.0        0.0

[4209 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39  0.450000       0.0  0.750000        0.0        0.0        0.0
2     150.44  0.286597       0.0 -0.272338        0.0        0.0        0.0
3     150.49  0.194530       0.0 -0.153445        0.0        0.0        0.0
4     150.54  0.160554       0.0 -0.056627        0.0        0.0        0.0
…      …        …        …        …         …         …         …
4233  361.99  0.003770       0.0 -0.000045        0.0        0.0        0.0
4234  362.04  0.003743       0.0 -0.000044        0.0        0.0        0.0
4235  362.09  0.003717       0.0 -0.000044        0.0        0.0        0.0
4236  362.14  0.003691       0.0 -0.000044        0.0        0.0        0.0
4237  362.19  0.003664       0.0 -0.000043        0.0        0.0        0.0

[4238 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
```

```
0     150.33 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.38 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.43 -1.206457       0.0  0.989081        0.0        0.0        0.0
3     150.48 -0.730946       0.0  0.792518        0.0        0.0        0.0
4     150.53 -0.351136       0.0  0.633016        0.0        0.0        0.0
…      …       …        …       …         …         …        …
4261  363.38  0.004101       0.0 -0.000049        0.0        0.0        0.0
4262  363.43  0.004072       0.0 -0.000048        0.0        0.0        0.0
4263  363.48  0.004044       0.0 -0.000048        0.0        0.0        0.0
4264  363.53  0.004015       0.0 -0.000047        0.0        0.0        0.0
4265  363.58  0.003987       0.0 -0.000047        0.0        0.0        0.0

[4266 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.31 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.36 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.41 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.46 -1.265367       0.0  0.490589        0.0        0.0        0.0
4     150.51 -0.945634       0.0  0.532889        0.0        0.0        0.0
…      …       …        …       …         …         …        …
4292  364.91  0.004318       0.0 -0.000051        0.0        0.0        0.0
4293  364.96  0.004288       0.0 -0.000050        0.0        0.0        0.0
4294  365.01  0.004258       0.0 -0.000050        0.0        0.0        0.0
4295  365.06  0.004228       0.0 -0.000050        0.0        0.0        0.0
4296  365.11  0.004198       0.0 -0.000050        0.0        0.0        0.0

[4297 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.32 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.37 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.42 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.47 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.52 -1.082859       0.0  0.401872        0.0        0.0        0.0
…      …       …        …       …         …         …        …
4330  366.82  0.004291       0.0 -0.000051        0.0        0.0        0.0
4331  366.87  0.004261       0.0 -0.000050        0.0        0.0        0.0
4332  366.92  0.004231       0.0 -0.000050        0.0        0.0        0.0
4333  366.97  0.004201       0.0 -0.000050        0.0        0.0        0.0
4334  367.02  0.004172       0.0 -0.000049        0.0        0.0        0.0

[4335 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.34 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.39  0.450000       0.0  0.750000        0.0        0.0        0.0
2     150.44  0.286597       0.0 -0.272338        0.0        0.0        0.0
3     150.49  0.194530       0.0 -0.153445        0.0        0.0        0.0
4     150.54  0.120679       0.0 -0.123085        0.0        0.0        0.0
```

```
…      …       …       …       …         …        …        …
4364  368.54  0.004348       0.0 -0.000051       0.0      0.0      0.0
4365  368.59  0.004317       0.0 -0.000051       0.0      0.0      0.0
4366  368.64  0.004287       0.0 -0.000051       0.0      0.0      0.0
4367  368.69  0.004256       0.0 -0.000051       0.0      0.0      0.0
4368  368.74  0.004226       0.0 -0.000050       0.0      0.0      0.0

[4369 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.31 -1.799905       0.0 -2.999842       0.0        0.0        0.0
1     150.36 -1.799905       0.0 -2.999842       0.0        0.0        0.0
2     150.41 -1.349906       0.0  0.749999       0.0        0.0        0.0
3     150.46 -0.825854       0.0  0.873420       0.0        0.0        0.0
4     150.51 -0.428905       0.0  0.661581       0.0        0.0        0.0
…      …       …       …       …         …        …        …
4433  371.96  0.003443       0.0 -0.000041       0.0      0.0      0.0
4434  372.01  0.003419       0.0 -0.000040       0.0      0.0      0.0
4435  372.06  0.003395       0.0 -0.000040       0.0      0.0      0.0
4436  372.11  0.003371       0.0 -0.000040       0.0      0.0      0.0
4437  372.16  0.003348       0.0 -0.000040       0.0      0.0      0.0

[4438 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.30 -1.799905       0.0 -2.999842       0.0        0.0        0.0
1     150.35 -1.799905       0.0 -2.999842       0.0        0.0        0.0
2     150.40 -1.559721       0.0  0.400308       0.0        0.0        0.0
3     150.45 -1.289075       0.0  0.451075       0.0        0.0        0.0
4     150.50 -0.980890       0.0  0.513643       0.0        0.0        0.0
…      …       …       …       …         …        …        …
4473  373.95  0.003371       0.0 -0.000040       0.0      0.0      0.0
4474  374.00  0.003348       0.0 -0.000039       0.0      0.0      0.0
4475  374.05  0.003324       0.0 -0.000039       0.0      0.0      0.0
4476  374.10  0.003301       0.0 -0.000039       0.0      0.0      0.0
4477  374.15  0.003277       0.0 -0.000039       0.0      0.0      0.0

[4478 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.31 -1.799905       0.0 -2.999842       0.0        0.0        0.0
1     150.36 -1.799905       0.0 -2.999842       0.0        0.0        0.0
2     150.41 -1.559721       0.0  0.400308       0.0        0.0        0.0
3     150.46 -1.323982       0.0  0.392897       0.0        0.0        0.0
4     150.51 -1.086838       0.0  0.395240       0.0        0.0        0.0
…      …       …       …       …         …        …        …
4519  376.26  0.003147       0.0 -0.000037       0.0      0.0      0.0
4520  376.31  0.003125       0.0 -0.000037       0.0      0.0      0.0
4521  376.36  0.003103       0.0 -0.000037       0.0      0.0      0.0
4522  376.41  0.003081       0.0 -0.000037       0.0      0.0      0.0
```

```
4523  376.46  0.003059       0.0 -0.000036        0.0        0.0        0.0

[4524 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.33 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.38 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.43 -1.522504       0.0  0.462335        0.0        0.0        0.0
3     150.48 -1.293688       0.0  0.381360        0.0        0.0        0.0
4     150.53 -1.068140       0.0  0.375913        0.0        0.0        0.0
…      …       …        …        …         …         …        …
4565  378.58  0.002919       0.0 -0.000034        0.0        0.0        0.0
4566  378.63  0.002899       0.0 -0.000034        0.0        0.0        0.0
4567  378.68  0.002878       0.0 -0.000034        0.0        0.0        0.0
4568  378.73  0.002858       0.0 -0.000034        0.0        0.0        0.0
4569  378.78  0.002838       0.0 -0.000034        0.0        0.0        0.0

[4570 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.33 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.38 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.43 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.48 -1.317772       0.0  0.403248        0.0        0.0        0.0
4     150.53 -1.082511       0.0  0.392101        0.0        0.0        0.0
…      …       …        …        …         …         …        …
4618  381.23  0.002585       0.0 -0.000031        0.0        0.0        0.0
4619  381.28  0.002567       0.0 -0.000030        0.0        0.0        0.0
4620  381.33  0.002549       0.0 -0.000030        0.0        0.0        0.0
4621  381.38  0.002531       0.0 -0.000030        0.0        0.0        0.0
4622  381.43  0.002513       0.0 -0.000030        0.0        0.0        0.0

[4623 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.31 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.36 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.41 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.46 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.51 -1.091659       0.0  0.387206        0.0        0.0        0.0
…      …       …        …        …         …         …        …
4671  383.86  0.002292       0.0 -0.000027        0.0        0.0        0.0
4672  383.91  0.002276       0.0 -0.000027        0.0        0.0        0.0
4673  383.96  0.002260       0.0 -0.000027        0.0        0.0        0.0
4674  384.01  0.002244       0.0 -0.000026        0.0        0.0        0.0
4675  384.06  0.002228       0.0 -0.000026        0.0        0.0        0.0

[4676 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.31 -1.799905       0.0 -2.999842        0.0        0.0        0.0
```

```
1     150.36 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.41 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.46 -1.323982       0.0  0.392897        0.0        0.0        0.0
4     150.51 -1.092703       0.0  0.385466        0.0        0.0        0.0
…       …       …        …       …         …        …        …
4729  386.76  0.001963       0.0 -0.000023        0.0        0.0        0.0
4730  386.81  0.001949       0.0 -0.000023        0.0        0.0        0.0
4731  386.86  0.001936       0.0 -0.000023        0.0        0.0        0.0
4732  386.91  0.001922       0.0 -0.000023        0.0        0.0        0.0
4733  386.96  0.001908       0.0 -0.000023        0.0        0.0        0.0

[4734 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.33 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.38 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.43 -1.522504       0.0  0.462335        0.0        0.0        0.0
3     150.48 -1.293688       0.0  0.381360        0.0        0.0        0.0
4     150.53 -1.031173       0.0  0.437525        0.0        0.0        0.0
…       …       …        …       …         …        …        …
4778  389.23  0.001790       0.0 -0.000021        0.0        0.0        0.0
4779  389.28  0.001777       0.0 -0.000021        0.0        0.0        0.0
4780  389.33  0.001765       0.0 -0.000021        0.0        0.0        0.0
4781  389.38  0.001752       0.0 -0.000021        0.0        0.0        0.0
4782  389.43  0.001740       0.0 -0.000020        0.0        0.0        0.0

[4783 rows x 7 columns],
        Time  linear.x  linear.y  linear.z  angular.x  angular.y  angular.z
0     150.33 -1.799905       0.0 -2.999842        0.0        0.0        0.0
1     150.38 -1.799905       0.0 -2.999842        0.0        0.0        0.0
2     150.43 -1.559721       0.0  0.400308        0.0        0.0        0.0
3     150.48 -1.317772       0.0  0.403248        0.0        0.0        0.0
4     150.53 -1.082511       0.0  0.392101        0.0        0.0        0.0
…       …       …        …       …         …        …        …
4850  392.83  0.001390       0.0 -0.000017        0.0        0.0        0.0
4851  392.88  0.001380       0.0 -0.000016        0.0        0.0        0.0
4852  392.93  0.001370       0.0 -0.000016        0.0        0.0        0.0
4853  392.98  0.001360       0.0 -0.000016        0.0        0.0        0.0
4854  393.03  0.001351       0.0 -0.000016        0.0        0.0        0.0

[4855 rows x 7 columns]]]
```

[49]:
```
len(cmd_speed)
```

[49]: 2

[50]:
```
len(cmd_speed[0])
```

[50]: 24

[51]:
```
cmd1sim1 = cmd_speed[0][0]
```

[52]:
```
cmd1sim2 = cmd_speed[1][0]
```

[53]:
```
cmd1sim1
```

[53]:

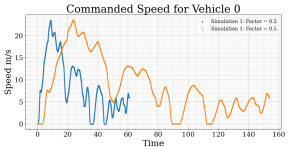
	Time	linear.x	linear.y	linear.z	angular.x	angular.y	angular.z
0	59.72	0.00	0.0	0.0	0.0	0.0	0.0
1	59.72	0.00	0.0	0.0	0.0	0.0	0.0
2	59.73	0.00	0.0	0.0	0.0	0.0	0.0
3	59.74	0.00	0.0	0.0	0.0	0.0	0.0
4	59.74	0.00	0.0	0.0	0.0	0.0	0.0
…	…	…	…	…	…	…	…
11371	120.54	5.87	0.0	0.0	0.0	0.0	0.0
11372	120.55	5.85	0.0	0.0	0.0	0.0	0.0
11373	120.56	5.85	0.0	0.0	0.0	0.0	0.0
11374	120.57	5.84	0.0	0.0	0.0	0.0	0.0
11375	120.57	5.84	0.0	0.0	0.0	0.0	0.0

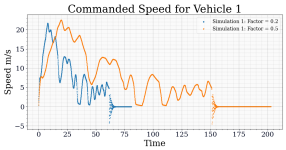
[11376 rows x 7 columns]

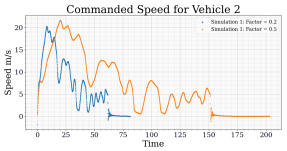
[54]:
```
fig, ax = bagpy.create_fig(ncols = 2, nrows = int(np.ceil(n_cars/2)))
for j in range(0, len(cmd_speed[0])):
    p = [0, 0.0]
    marker = ["o", "v", "s"]
    s= [2.0, 2.0, 2.0]
    lb = [  'Simulation 1: Factor = 0.2', \
            'Simulation 1: Factor = 0.5']

    for k in range(0, len(cmd_speed)):

        time = cmd_speed[k][j]['Time'].tolist()
        ax[j].scatter(x= cmd_speed[k][j]['Time'] + p[k] -␣
↪cmd_speed[k][j]['Time'].iloc[0], y = cmd_speed[k][j]['linear.x']  ,  s =␣
↪s[k], label = lb[k], marker =marker[k])


    ax[j].legend()
    ax[j].set_xlabel('Time')
    ax[j].set_ylabel('Speed m/s')
    ax[j].set_title('Commanded Speed for Vehicle {}'.format(j))
    fig.show()
```

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-NoGUI.py:19: UserWarning:

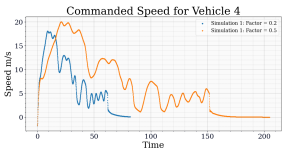
```
Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.
```

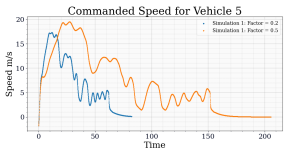

Commanded Speed for Vehicle 0
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

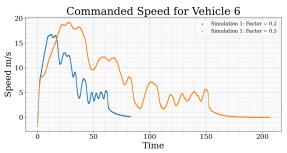

Commanded Speed for Vehicle 1
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

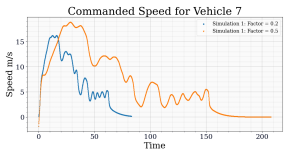

Commanded Speed for Vehicle 2
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

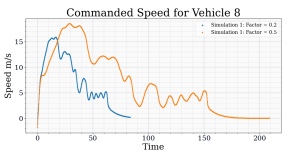

Commanded Speed for Vehicle 3
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

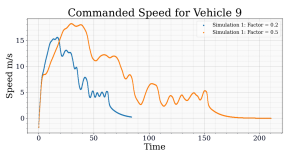

Commanded Speed for Vehicle 4
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

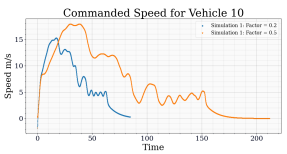

Commanded Speed for Vehicle 5
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

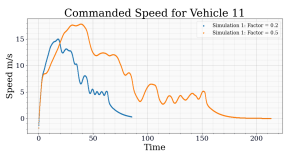

Commanded Speed for Vehicle 6
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

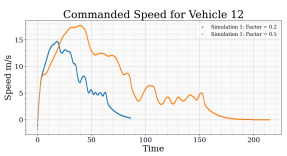

Commanded Speed for Vehicle 7
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

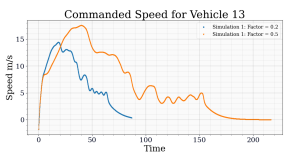

Commanded Speed for Vehicle 8
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

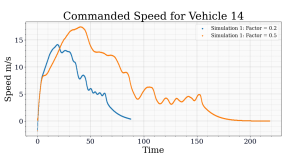

Commanded Speed for Vehicle 9
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

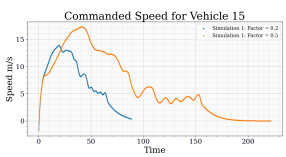

Commanded Speed for Vehicle 10
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

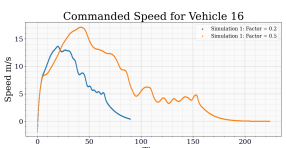

Commanded Speed for Vehicle 11
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

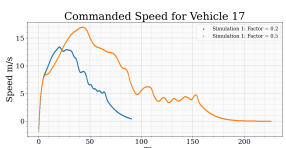

Commanded Speed for Vehicle 12
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

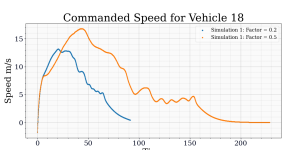

Commanded Speed for Vehicle 13
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

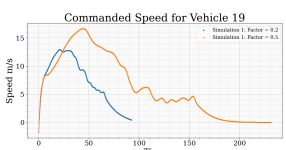

Commanded Speed for Vehicle 14
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

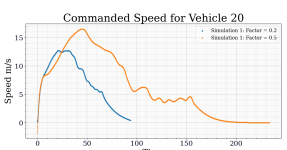

Commanded Speed for Vehicle 15
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

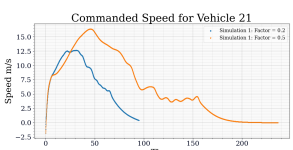

Commanded Speed for Vehicle 16
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

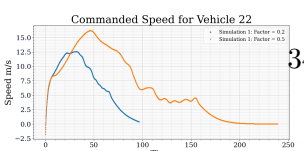

Commanded Speed for Vehicle 17
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

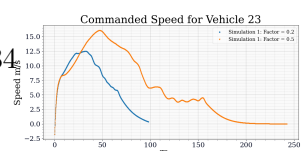

Commanded Speed for Vehicle 18
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 19
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 20
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 21
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 22
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time


Commanded Speed for Vehicle 23
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

[55]:
```
cmd_speed[1][22]['Time']
```

[55]:
```
0       150.33
1       150.38
2       150.43
3       150.48
4       150.53
         …
4778    389.23
4779    389.28
4780    389.33
4781    389.38
4782    389.43
Name: Time, Length: 4783, dtype: float64
```

[56]:
```
cmd_speed[1][0]['linear.x']
```

[56]:
```
0        0.00
1        0.00
2        0.00
3        0.00
4        0.00
         …
11526    5.87
11527    5.85
11528    5.85
11529    5.84
11530    5.84
Name: linear.x, Length: 11531, dtype: float64
```

[57]:
```
cmd_speed[1][0]['linear.x'].tolist()
```

[57]:
```
[0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
0.0,
```

```
0.0,
0.0,
0.0,
0.0,
0.0,
0.3899999856948852,
0.4199999868869781,
0.4300000071525574,
0.449999988079071,
0.4699999988079071,
0.4799999892711639,
0.5,
0.5099999904632568,
0.5299999713897705,
0.5400000214576721,
0.5600000023841858,
0.5799999833106995,
0.5899999737739563,
0.6100000143051147,
0.6299999952316284,
0.6399999856948853,
0.6600000262260437,
0.6800000071525574,
0.6899999976158142,
0.7099999785423279,
0.7200000286102295,
0.75,
0.7699999809265137,
0.7799999713897705,
0.800000011920929,
0.8199999928474426,
0.8399999737739563,
0.8500000238418579,
0.8700000047683716,
0.8899999856948853,
0.9100000262260436,
0.9300000071525574,
0.949999988079071,
0.9700000286102296,
0.9900000095367432,
1.0199999809265137,
1.0399999618530271,
1.059999942779541,
1.0800000429153442,
1.100000023841858,
1.1299999952316284,
1.149999976158142,
```

```
1.1699999570846558,
1.2000000476837158,
1.2300000190734863,
1.2400000095367432,
1.2799999713897705,
1.2999999523162842,
1.3300000429153442,
1.3700000047683716,
1.3899999856948853,
1.4199999570846558,
1.4500000476837158,
1.4900000095367432,
1.5099999904632568,
1.5399999618530271,
1.5700000524520874,
1.600000023841858,
1.6399999856948853,
1.6699999570846558,
1.7000000476837158,
1.7300000190734863,
1.7599999904632568,
1.7999999523162842,
1.830000042915344,
1.870000004768372,
1.8899999856948853,
1.9299999475479128,
1.9700000286102293,
2.0,
2.039999961853028,
2.0799999237060547,
2.119999885559082,
2.1600000858306885,
2.200000047683716,
2.240000009536743,
2.2699999809265137,
2.319999933242798,
2.3499999046325684,
2.390000104904175,
2.440000057220459,
2.470000028610229,
2.5,
2.559999942779541,
2.5899999141693115,
2.640000104904175,
2.6700000762939453,
2.7100000381469727,
2.75,
```

2.799999952316284,
2.8399999141693115,
2.890000104904175,
2.930000066757202,
2.970000028610229,
3.0199999809265137,
3.069999933242798,
3.109999895095825,
3.150000095367432,
3.2100000381469727,
3.25,
3.289999961853028,
3.3399999141693115,
3.400000095367432,
3.430000066757202,
3.4800000190734863,
3.5199999809265137,
3.569999933242798,
3.619999885559082,
3.660000085830689,
3.7100000381469727,
3.75,
3.799999952316284,
3.839999914169312,
3.869999885559082,
3.930000066757202,
3.9700000286102295,
4.010000228881836,
4.059999942779541,
4.110000133514404,
4.150000095367432,
4.179999828338623,
4.260000228881836,
4.28000020980835,
4.340000152587891,
4.369999885559082,
4.429999828338623,
4.46999979019165,
4.510000228881836,
4.550000190734863,
4.590000152587891,
4.639999866485596,
4.670000076293945,
4.710000038146973,
4.760000228881836,
4.789999961853027,
4.840000152587891,

```
4.869999885559082,
4.929999828338623,
4.960000038146973,
5.0,
5.050000190734863,
5.070000171661377,
5.139999866485596,
5.179999828338623,
5.210000038146973,
5.260000228881836,
5.289999961853027,
5.349999904632568,
5.369999885559082,
5.429999828338623,
5.440000057220459,
5.489999771118164,
5.539999961853027,
5.559999942779541,
5.610000133514404,
5.639999866485596,
5.690000057220459,
5.71999979019165,
5.769999980926514,
5.800000190734863,
5.840000152587891,
5.880000114440918,
5.920000076293945,
5.940000057220459,
5.989999771118164,
6.019999980926514,
6.070000171661377,
6.099999904632568,
6.119999885559082,
6.170000076293945,
6.199999809265137,
6.230000019073486,
6.28000020980835,
6.320000171661377,
6.340000152587891,
6.380000114440918,
6.429999828338623,
6.449999809265137,
6.489999771118164,
6.519999980926514,
6.559999942779541,
6.590000152587891,
6.619999885559082,
```

6.650000095367432,
6.690000057220459,
6.730000019073486,
6.739999771118164,
6.800000190734863,
6.800000190734863,
6.860000133514404,
6.869999885559082,
6.929999828338623,
6.949999809265137,
6.980000019073486,
7.019999980926514,
7.059999942779541,
7.110000133514404,
7.119999885559082,
7.150000095367432,
7.190000057220459,
7.239999771118164,
7.210000038146973,
7.300000190734863,
7.289999961853027,
7.329999923706055,
7.340000152587891,
7.369999885559082,
7.389999866485596,
7.409999847412109,
7.440000057220459,
7.460000038146973,
7.449999809265137,
7.5,
7.489999771118164,
7.489999771118164,
7.53000020980835,
7.539999961853027,
7.53000020980835,
7.579999923706055,
7.599999904632568,
7.579999923706055,
7.590000152587891,
7.599999904632568,
7.599999904632568,
7.630000114440918,
7.619999885559082,
7.619999885559082,
7.630000114440918,
7.639999866485596,
7.630000114440918,

7.630000114440918,
7.610000133514404,
7.610000133514404,
7.610000133514404,
7.610000133514404,
7.619999885559082,
7.619999885559082,
7.630000114440918,
7.630000114440918,
7.619999885559082,
7.619999885559082,
7.599999904632568,
7.619999885559082,
7.610000133514404,
7.619999885559082,
7.599999904632568,
7.599999904632568,
7.599999904632568,
7.590000152587891,
7.570000171661377,
7.579999923706055,
7.550000190734863,
7.539999961853027,
7.550000190734863,
7.550000190734863,
7.539999961853027,
7.539999961853027,
7.53000020980835,
7.53000020980835,
7.5,
7.53000020980835,
7.5,
7.510000228881836,
7.519999980926514,
7.510000228881836,
7.510000228881836,
7.489999771118164,
7.480000019073486,
7.480000019073486,
7.480000019073486,
7.46999979019165,
7.46999979019165,
7.46999979019165,
7.460000038146973,
7.449999809265137,
7.440000057220459,
7.440000057220459,

7.420000076293945,
7.420000076293945,
7.400000095367432,
7.420000076293945,
7.420000076293945,
7.409999847412109,
7.409999847412109,
7.420000076293945,
7.389999866485596,
7.400000095367432,
7.389999866485596,
7.380000114440918,
7.360000133514404,
7.369999885559082,
7.360000133514404,
7.369999885559082,
7.349999904632568,
7.360000133514404,
7.329999923706055,
7.340000152587891,
7.329999923706055,
7.309999942779541,
7.320000171661377,
7.329999923706055,
7.300000190734863,
7.309999942779541,
7.320000171661377,
7.289999961853027,
7.320000171661377,
7.300000190734863,
7.289999961853027,
7.269999980926514,
7.289999961853027,
7.269999980926514,
7.25,
7.260000228881836,
7.269999980926514,
7.28000020980835,
7.269999980926514,
7.269999980926514,
7.25,
7.230000019073486,
7.25,
7.230000019073486,
7.21999979019165,
7.21999979019165,
7.21999979019165,

7.21999979019165,
7.230000019073486,
7.190000057220459,
7.21999979019165,
7.179999828338623,
7.159999847412109,
7.130000114440918,
7.150000095367432,
7.090000152587891,
7.159999847412109,
7.150000095367432,
7.099999904632568,
7.139999866485596,
7.139999866485596,
7.139999866485596,
7.170000076293945,
7.159999847412109,
7.159999847412109,
7.139999866485596,
7.150000095367432,
7.110000133514404,
7.150000095367432,
7.179999828338623,
7.199999809265137,
7.21999979019165,
7.269999980926514,
7.21999979019165,
7.25,
7.239999771118164,
7.260000228881836,
7.21999979019165,
7.21999979019165,
7.21999979019165,
7.230000019073486,
7.210000038146973,
7.21999979019165,
7.199999809265137,
7.199999809265137,
7.199999809265137,
7.230000019073486,
7.199999809265137,
7.199999809265137,
7.25,
7.239999771118164,
7.260000228881836,
7.300000190734863,
7.329999923706055,

7.349999904632568,
7.400000095367432,
7.409999847412109,
7.429999828338623,
7.420000076293945,
7.5,
7.5,
7.5,
7.489999771118164,
7.539999961853027,
7.519999980926514,
7.5,
7.53000020980835,
7.510000228881836,
7.510000228881836,
7.510000228881836,
7.550000190734863,
7.539999961853027,
7.559999942779541,
7.550000190734863,
7.590000152587891,
7.590000152587891,
7.550000190734863,
7.610000133514404,
7.659999847412109,
7.710000038146973,
7.659999847412109,
7.670000076293945,
7.769999980926514,
7.809999942779541,
7.659999847412109,
7.639999866485596,
7.730000019073486,
7.849999904632568,
7.769999980926514,
7.670000076293945,
7.789999961853027,
7.699999809265137,
7.690000057220459,
7.760000228881836,
7.690000057220459,
7.71999979019165,
7.710000038146973,
7.670000076293945,
7.739999771118164,
7.690000057220459,
7.670000076293945,

7.699999809265137,
7.71999979019165,
7.75,
7.71999979019165,
7.75,
7.769999980926514,
7.789999961853027,
7.769999980926514,
7.840000152587891,
7.840000152587891,
7.809999942779541,
7.869999885559082,
7.849999904632568,
7.860000133514404,
7.880000114440918,
7.889999866485596,
7.880000114440918,
7.889999866485596,
7.909999847412109,
7.920000076293945,
7.949999809265137,
7.929999828338623,
7.949999809265137,
7.989999771118164,
7.980000019073486,
8.010000228881836,
8.020000457763672,
8.039999961853027,
8.050000190734863,
8.0600004196167,
8.069999694824219,
8.079999923706055,
8.09000015258789,
8.100000381469727,
8.119999885559082,
8.130000114440918,
8.140000343322754,
8.149999618530273,
8.149999618530273,
8.220000267028809,
8.199999809265137,
8.229999542236328,
8.239999771118164,
8.25,
8.239999771118164,
8.279999732971191,
8.279999732971191,

8.319999694824219,
8.3100004196167,
8.329999923706055,
8.34000015258789,
8.34000015258789,
8.369999885559082,
8.350000381469727,
8.359999656677246,
8.390000343322754,
8.390000343322754,
8.40999984741211,
8.420000076293945,
8.430000305175781,
8.4399995803833,
8.4399995803833,
8.449999809265137,
8.460000038146973,
8.489999771118164,
8.520000457763672,
8.529999732971191,
8.5600004196167,
8.569999694824219,
8.600000381469727,
8.619999885559082,
8.640000343322754,
8.65999984741211,
8.680000305175781,
8.6899995803833,
8.710000038146973,
8.729999542236328,
8.739999771118164,
8.720000267028809,
8.770000457763672,
8.800000190734863,
8.800000190734863,
8.8100004196167,
8.850000381469727,
8.84000015258789,
8.859999656677246,
8.880000114440918,
8.890000343322754,
8.920000076293945,
8.890000343322754,
8.920000076293945,
8.9399995803833,
9.0,
8.9399995803833,

```
9.0,
8.989999771118164,
9.010000228881836,
9.0,
9.050000190734863,
9.050000190734863,
9.050000190734863,
9.0600004196167,
9.06999969482422,
9.09000015258789,
9.09000015258789,
9.119999885559082,
9.119999885559082,
9.15999984741211,
9.15999984741211,
9.170000076293944,
9.18000030517578,
9.1899995803833,
9.220000267028809,
9.220000267028809,
9.25,
9.25,
9.289999961853027,
9.279999732971191,
9.279999732971191,
9.289999961853027,
9.31999969482422,
9.31999969482422,
9.34000015258789,
9.31999969482422,
9.369999885559082,
9.399999618530272,
9.43000030517578,
9.4399995803833,
9.4399995803833,
9.470000267028809,
9.5,
9.5,
9.5,
9.529999732971191,
9.550000190734863,
9.56999969482422,
9.600000381469728,
9.630000114440918,
9.619999885559082,
9.619999885559082,
9.640000343322754,
```

9.640000343322754,
9.68000030517578,
9.699999809265137,
9.720000267028809,
9.729999542236328,
9.739999771118164,
9.779999732971191,
9.789999961853027,
9.8100004196167,
9.81999969482422,
9.869999885559082,
9.869999885559082,
9.899999618530272,
9.920000076293944,
9.949999809265137,
9.960000038146973,
9.979999542236328,
9.989999771118164,
10.0,
10.039999961853027,
10.050000190734863,
10.06999969482422,
10.09000015258789,
10.130000114440918,
10.140000343322754,
10.170000076293944,
10.18000030517578,
10.220000267028809,
10.239999771118164,
10.270000457763672,
10.289999961853027,
10.3100004196167,
10.31999969482422,
10.350000381469728,
10.350000381469728,
10.380000114440918,
10.399999618530272,
10.40999984741211,
10.449999809265137,
10.449999809265137,
10.489999771118164,
10.510000228881836,
10.510000228881836,
10.529999732971191,
10.550000190734863,
10.59000015258789,
10.619999885559082,

10.640000343322754,
10.65999984741211,
10.699999809265137,
10.699999809265137,
10.739999771118164,
10.760000228881836,
10.789999961853027,
10.800000190734863,
10.850000381469728,
10.859999656677246,
10.899999618530272,
10.90999984741211,
10.920000076293944,
10.9399995803833,
10.970000267028809,
10.970000267028809,
11.020000457763672,
11.039999961853027,
11.039999961853027,
11.050000190734863,
11.09000015258789,
11.119999885559082,
11.119999885559082,
11.210000038146973,
11.18000030517578,
11.199999809265137,
11.220000267028809,
11.239999771118164,
11.289999961853027,
11.31999969482422,
11.350000381469728,
11.369999885559082,
11.40999984741211,
11.420000076293944,
11.460000038146973,
11.479999542236328,
11.510000228881836,
11.529999732971191,
11.529999732971191,
11.550000190734863,
11.56999969482422,
11.59000015258789,
11.619999885559082,
11.65999984741211,
11.670000076293944,
11.699999809265137,
11.739999771118164,

```
11.75,
11.770000457763672,
11.800000190734863,
11.850000381469728,
11.880000114440918,
11.880000114440918,
11.920000076293944,
11.9399995803833,
11.960000038146973,
11.970000267028809,
11.989999771118164,
12.029999732971191,
12.039999961853027,
12.0600004196167,
12.09000015258789,
12.119999885559082,
12.140000343322754,
12.1899995803833,
12.199999809265137,
12.15999984741211,
12.199999809265137,
12.229999542236328,
12.289999961853027,
12.31999969482422,
12.34000015258789,
12.369999885559082,
12.380000114440918,
12.420000076293944,
12.4399995803833,
12.470000267028809,
12.510000228881836,
12.550000190734863,
12.56999969482422,
12.59000015258789,
12.600000381469728,
12.630000114440918,
12.649999618530272,
12.65999984741211,
12.75,
12.729999542236328,
12.739999771118164,
12.760000228881836,
12.770000457763672,
12.8100004196167,
12.800000190734863,
12.850000381469728,
12.850000381469728,
```

…]

[58]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0]
```

[58]:

	Time	linear.x	linear.y	linear.z	angular.x	angular.y	angular.z
300	149.42	0.39	0.0	0.0	0.0	0.0	0.0
301	149.43	0.42	0.0	0.0	0.0	0.0	0.0
302	149.44	0.43	0.0	0.0	0.0	0.0	0.0
303	149.45	0.45	0.0	0.0	0.0	0.0	0.0
304	149.46	0.47	0.0	0.0	0.0	0.0	0.0
…	…	…	…	…	…	…	…
11526	299.62	5.87	0.0	0.0	0.0	0.0	0.0
11527	299.65	5.85	0.0	0.0	0.0	0.0	0.0
11528	299.66	5.85	0.0	0.0	0.0	0.0	0.0
11529	299.68	5.84	0.0	0.0	0.0	0.0	0.0
11530	299.68	5.84	0.0	0.0	0.0	0.0	0.0

[10526 rows x 7 columns]

[59]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0].iloc[0]
```

[59]:
```
Time         149.42
linear.x       0.39
linear.y       0.00
linear.z       0.00
angular.x      0.00
angular.y      0.00
angular.z      0.00
Name: 300, dtype: float64
```

[60]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0].iloc[0]['Time']
```

[60]:
```
149.42
```

[61]:
```
fig, ax = bagpy.create_fig(ncols = 2, nrows = int(np.ceil(n_cars/2)))
for j in range(0, len(cmd_speed[0])):
    p = [0, 0.0]
    marker = ["o", "v", "s"]
    s= [2.0, 2.0, 2.0]
    lb = [  'Simulation 1: Factor = 0.2', \
            'Simulation 1: Factor = 0.5']
    for k in range(0, len(cmd_speed)):
        time = cmd_speed[k][j]['Time'].tolist()
        t0 = cmd_speed[k][0][cmd_speed[1][0]['linear.x'] > 0].iloc[0]['Time']
        ax[j].scatter(x= cmd_speed[k][j]['Time'] + p[k] - t0, y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = s[k], label = lb[k], marker =marker[k])
    ax[j].legend()
```

```
    ax[j].set_xlabel('Time')
    ax[j].set_ylabel('Speed m/s')
    ax[j].set_title('Commanded Speed for Vehicle {}'.format(j))
    fig.show()
```

```
/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
```

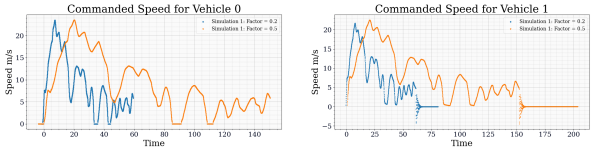
```
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:
```

```
Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
```

```
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.
```

```
/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:
```

```
Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:10: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:16: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.
```


Commanded Speed for Vehicle 0
Commanded Speed for Vehicle 1
Commanded Speed for Vehicle 2
Commanded Speed for Vehicle 3
Commanded Speed for Vehicle 4
Commanded Speed for Vehicle 5
Commanded Speed for Vehicle 6
Commanded Speed for Vehicle 7
Commanded Speed for Vehicle 8
Commanded Speed for Vehicle 9
Commanded Speed for Vehicle 10
Commanded Speed for Vehicle 11
Commanded Speed for Vehicle 12
Commanded Speed for Vehicle 13
Commanded Speed for Vehicle 14
Commanded Speed for Vehicle 15
Commanded Speed for Vehicle 16
Commanded Speed for Vehicle 17
Commanded Speed for Vehicle 18
Commanded Speed for Vehicle 19
Commanded Speed for Vehicle 20
Commanded Speed for Vehicle 21
Commanded Speed for Vehicle 22
Commanded Speed for Vehicle 23
Simulation 1: Factor = 0.2
Simulation 1: Factor = 0.5
Speed m/s
Time

[62]:
```
cmd_speed[1][0]['Time'].diff()
```

[62]:
```
0         NaN
1        0.01
2        0.01
3        0.01
4        0.02
         …
11526    0.02
11527    0.03
11528    0.01
11529    0.02
11530    0.00
Name: Time, Length: 11531, dtype: float64
```

[63]:
```
cmd_speed[0][0]['Time'].diff()
```

[63]:
```
0         NaN
1        0.00
2        0.01
3        0.01
4        0.00
         …
11371    0.00
11372    0.01
11373    0.01
11374    0.01
11375    0.00
Name: Time, Length: 11376, dtype: float64
```

[64]:
```
cmd_speed[1][1]['Time'].diff()
```

[64]:
```
0        NaN
1       0.05
2       0.05
3       0.05
4       0.05
        …
4054    0.05
4055    0.05
4056    0.05
4057    0.05
4058    0.05
Name: Time, Length: 4059, dtype: float64
```

[65]:
```
cmd_speed[0][1]['Time'].diff()
```

[65]:
```
0        NaN
1       0.05
2       0.05
3       0.05
4       0.05
        …
1619    0.05
1620    0.05
1621    0.05
1622    0.05
1623    0.05
Name: Time, Length: 1624, dtype: float64
```

[66]:
```
cmd_speed[0][1]['Time']
```

[66]:
```
0        60.83
1        60.88
2        60.93
3        60.98
4        61.03
         …
1619    141.78
1620    141.83
1621    141.88
1622    141.93
1623    141.98
Name: Time, Length: 1624, dtype: float64
```

[67]:
```
cmd_speed[1][1]['Time']
```

[67]:
```
0       150.32
1       150.37
2       150.42
3       150.47
4       150.52
        …
4054    353.02
4055    353.07
4056    353.12
4057    353.17
4058    353.22
Name: Time, Length: 4059, dtype: float64
```

[68]:
```
cmd_speed[0][1]['Time'].diff()
```

[68]:
```
0        NaN
1       0.05
2       0.05
3       0.05
4       0.05
        …
1619    0.05
1620    0.05
1621    0.05
1622    0.05
1623    0.05
Name: Time, Length: 1624, dtype: float64
```

[69]:
```
cmd_speed[1][1]['Time'].diff()
```

[69]:
```
0        NaN
1       0.05
2       0.05
3       0.05
4       0.05
        …
4054    0.05
4055    0.05
4056    0.05
4057    0.05
4058    0.05
Name: Time, Length: 4059, dtype: float64
```

[70]:
```
clock_df1
```

[70]:

	Time	clock.secs	clock.nsecs	Total_Time	Tdiff
0	28.66	28	360000000	28.36	NaN
1	28.66	28	370000000	28.37	0.01
2	28.66	28	380000000	28.38	0.01
3	28.66	28	390000000	28.39	0.01
4	28.66	28	400000000	28.40	0.01
…	…	…	…	…	…
13161	159.97	159	970000000	159.97	0.01
13162	159.98	159	980000000	159.98	0.01
13163	159.99	159	990000000	159.99	0.01
13164	160.00	160	0	160.00	0.01
13165	160.01	160	10000000	160.01	0.01

[13166 rows x 5 columns]

[71]:
```
clock_df2
```

[71]:
```
          Time  clock.secs  clock.nsecs  Total_Time  Tdiff
0       71.58          70    770000000       70.77    NaN
1       71.58          70    780000000       70.78   0.01
2       71.58          70    790000000       70.79   0.01
3       71.58          70    800000000       70.80   0.01
4       71.58          70    810000000       70.81   0.01
…         …          …           …          …     …
32444  395.21         395    210000000      395.21   0.01
32445  395.22         395    220000000      395.22   0.01
32446  395.23         395    230000000      395.23   0.01
32447  395.24         395    240000000      395.24   0.01
32448  395.25         395    250000000      395.25   0.01

[32449 rows x 5 columns]
```

[72]:
```
clock_df1['Time'].diff()
```

[72]:
```
0         NaN
1        0.00
2        0.00
3        0.00
4        0.00
         …
13161    0.01
13162    0.01
13163    0.01
13164    0.01
13165    0.01
Name: Time, Length: 13166, dtype: float64
```

[73]:
```
clock_df2['Time'].diff()
```

[73]:
```
0         NaN
1        0.00
2        0.00
3        0.00
4        0.00
         …
32444    0.01
32445    0.01
32446    0.01
32447    0.01
32448    0.01
Name: Time, Length: 32449, dtype: float64
```

[74]:
```
clock_df2['Time'].diff()[0].iloc[0]
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
~/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-NoGUI.py in␣
 ↪<module>
----> 1 clock_df2['Time'].diff()[0].iloc[0]

AttributeError: 'numpy.float64' object has no attribute 'iloc'
```

[75]:
```
clock_df2['Time'].diff().iloc[0]
```

[75]:
```
nan
```

[76]:
```
clock_df2['Time'].diff().iloc[1]
```

[76]:
```
0.0
```

[77]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[0]))
```

```
   nan
```

[78]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[1]))
```

```
0.000000000000000000
```

[79]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[2]))
```

```
0.000000000000000000
```

[80]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[20]))
```

```
0.000000000000000000
```

[81]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[200]))
```

```
0.009999999999990905
```

[82]:
```
print("{0:7.18f}".format(clock_df2['Time'].diff().iloc[2000]))
```

```
0.009999999999990905
```

[83]:
```
print("{0:7.18f}".format(clock_df1['Time'].diff().iloc[2000]))
```

```
0.009999999999998010
```

[84]:
```
print("{0:7.18f}".format(clock_df1['Total_Time'].diff().iloc[2000]))
```

```
0.009999999999998010
```

[85]:
```
print("{0:7.18f}".format(clock_df2['Total_Time'].diff().iloc[2000]))
```

```
0.009999999999990905
```

[86]:
```
cmd_speed[0][0]['Time'].shape
```

[86]:
```
(11376,)
```

[87]:
```
cmd_speed[1][0]['Time'].shape
```

[87]:
```
(11531,)
```

[88]:
```
cmd_speed[0][1]['Time'].shape
```

[88]:
```
(1624,)
```

[89]:
```
cmd_speed[0][2]['Time'].shape
```

[89]:
```
(1627,)
```

[90]:
```
cmd_speed[1][1]['Time'].shape
```

[90]:
```
(4059,)
```

[91]:
```
cmd_speed[0][1]['Time'] - cmd_speed[0][1]['Time'].iloc[0]
```

[91]:
```
0        0.00
1        0.05
2        0.10
3        0.15
4        0.20
        ...
1619    80.95
1620    81.00
1621    81.05
1622    81.10
1623    81.15
Name: Time, Length: 1624, dtype: float64
```

[92]:
```
cmd_speed[1][1]['Time'] - cmd_speed[1][1]['Time'].iloc[0]
```

[92]:
```
0         0.00
1         0.05
2         0.10
3         0.15
4         0.20
         ...
```

```
4054    202.70
4055    202.75
4056    202.80
4057    202.85
4058    202.90
Name: Time, Length: 4059, dtype: float64
```

[112]:
```
t0 = cmd_speed[0][0][cmd_speed[0][0]['linear.x'] > 0].iloc[0]['Time']
```

[113]:
```
t0
```

[113]:
```
60.46
```

[115]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0].iloc[0]['Time']
```

[115]:
```
149.42
```

[118]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0].iloc[0]['Time']
```

[118]:
```
149.42
```

[119]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0].iloc[-1]['Time']
```

[119]:
```
299.68
```

[120]:
```
cmd_speed[1][0]['linear.x'] > 0]
```

```
  File "<ipython-input-120-b3599b125b63>", line 1
    cmd_speed[1][0]['linear.x'] > 0]
                                    ^
SyntaxError: invalid syntax
```

[121]:
```
cmd_speed[1][0]['linear.x'] > 0
```

[121]:
```
0        False
1        False
2        False
3        False
4        False
         …
11526     True
11527     True
11528     True
11529     True
11530     True
```

```
Name: linear.x, Length: 11531, dtype: bool
```

[122]:
```
cmd_speed[1][0][cmd_speed[1][0]['linear.x'] > 0]
```

[122]:

	Time	linear.x	linear.y	linear.z	angular.x	angular.y	angular.z
300	149.42	0.39	0.0	0.0	0.0	0.0	0.0
301	149.43	0.42	0.0	0.0	0.0	0.0	0.0
302	149.44	0.43	0.0	0.0	0.0	0.0	0.0
303	149.45	0.45	0.0	0.0	0.0	0.0	0.0
304	149.46	0.47	0.0	0.0	0.0	0.0	0.0
…	…	…	…	…	…	…	…
11526	299.62	5.87	0.0	0.0	0.0	0.0	0.0
11527	299.65	5.85	0.0	0.0	0.0	0.0	0.0
11528	299.66	5.85	0.0	0.0	0.0	0.0	0.0
11529	299.68	5.84	0.0	0.0	0.0	0.0	0.0
11530	299.68	5.84	0.0	0.0	0.0	0.0	0.0

[10526 rows x 7 columns]

[128]:
```
fig, ax = plt.subplots(int(np.ceil(n_cars/2)), 2)
ax = ax.ravel()
for j in range(0, len(cmd_speed[0])):
    marker = ["o", "v", "s"]
    s= [2.0, 2.0, 2.0]
    lb = [  'Simulation 1: Factor = 0.2', \
            'Simulation 1: Factor = 0.5']
    ax2 = ax[j].twiny()
    axx = [ax[j], ax2]
    color =['green', 'red']
    legend_loc = ['upper right', 'upper left']
    for k in range(0, len(cmd_speed)):
        time = cmd_speed[k][j]['Time'].tolist()
        t0 = cmd_speed[k][0][cmd_speed[k][0]['linear.x'] > 0].iloc[0]['Time']
        axx[k].scatter(x= cmd_speed[k][j]['Time'] - t0, y =␣
↪cmd_speed[k][j]['linear.x']  ,  s = s[k], label = lb[k], marker =marker[k],␣
↪c=color[k])
        axx[k].grid(True)
        axx[k].tick_params(axis='x', labelcolor=color[k])
        axx[k].legend(loc=legend_loc[k])
        axx[k].set_xlabel('Time [s] (Simulation {})'.format(k))
    ax[j].set_ylabel('Speed m/s')
    ax[j].set_title('Commanded Speed for Vehicle {}'.format(j))
    fig.tight_layout()
    fig.show()
```

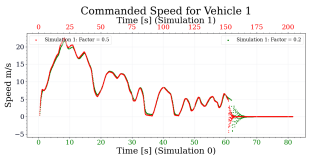
```
/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:
```

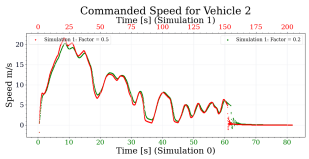
```
Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:
```

```
Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:
```

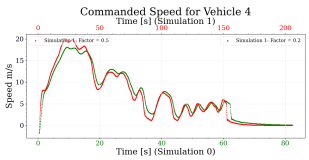
```
Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.

/home/refulgent/VersionControl/sparkle_python/notebooks/RTF_Analysis_Sparkle-
NoGUI.py:23: UserWarning:

Matplotlib is currently using module://ipykernel.pylab.backend_inline, which is
a non-GUI backend, so cannot show the figure.
```

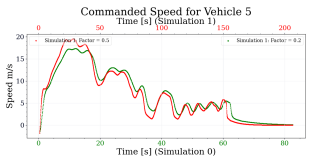

Commanded Speed for Vehicle 0
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

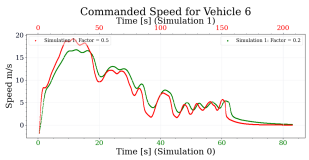

Commanded Speed for Vehicle 1
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

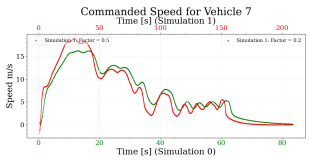

Commanded Speed for Vehicle 2
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

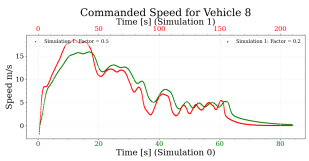

Commanded Speed for Vehicle 3
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

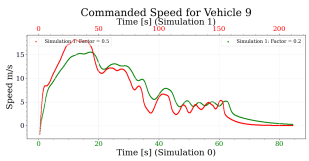

Commanded Speed for Vehicle 4
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

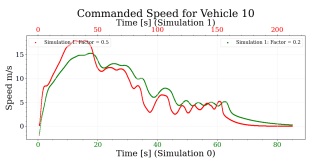

Commanded Speed for Vehicle 5
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

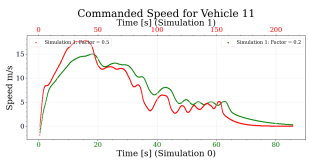

Commanded Speed for Vehicle 6
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

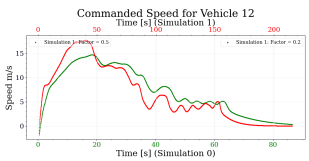

Commanded Speed for Vehicle 7
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

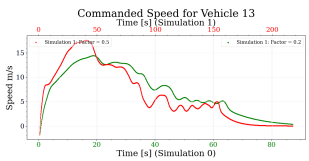

Commanded Speed for Vehicle 8
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

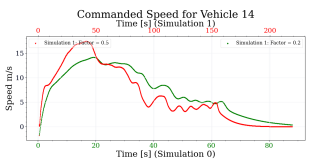

Commanded Speed for Vehicle 9
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

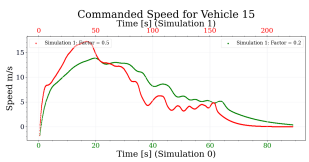

Commanded Speed for Vehicle 10
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

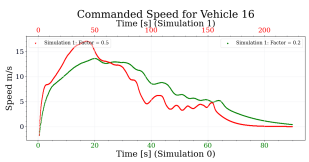

Commanded Speed for Vehicle 11
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

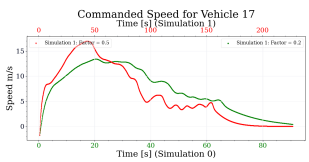

Commanded Speed for Vehicle 12
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

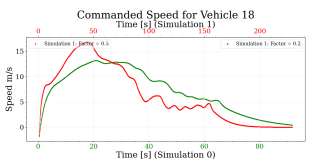

Commanded Speed for Vehicle 13
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

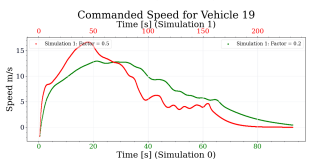

Commanded Speed for Vehicle 14
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

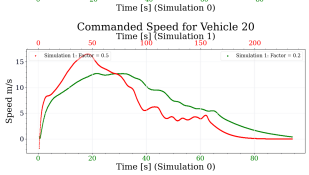

Commanded Speed for Vehicle 15
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

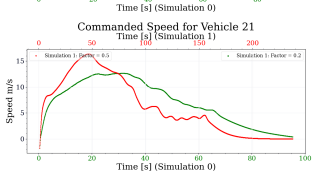

Commanded Speed for Vehicle 16
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

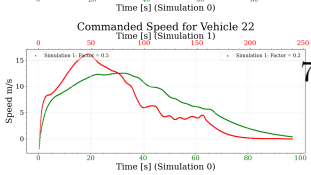

Commanded Speed for Vehicle 17
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)

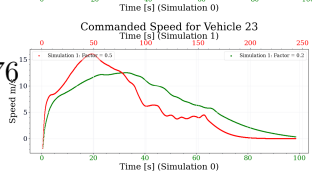

Commanded Speed for Vehicle 18
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)


Commanded Speed for Vehicle 19
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)


Commanded Speed for Vehicle 20
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)


Commanded Speed for Vehicle 21
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)


Commanded Speed for Vehicle 22
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)


Commanded Speed for Vehicle 23
Time [s] (Simulation 1)
Simulation 0: Factor = 0.5
Simulation 1: Factor = 0.2
Speed m/s
Time [s] (Simulation 0)