Correcting the Optical flow accross the image

The optical flow is not constant across the frame. It increases closer to the edges

This must be corrected

In [418…
```
user = 'marcvanzyl'
```

In [291…
```
import numpy as np
import cv2, os
from cv2 import aruco
import matplotlib.pyplot as plt
import matplotlib as mpl
import pandas as pd
import pickle
%matplotlib inline
```

Load the list of files

In [292…
```
datadir = "/Users/{}/Google Drive/ScienceFair2021/DataCapture/smooth/".format


data_files = np.array([f for f in os.listdir(datadir) if f.endswith("res2.p")

# just sorts the files according to the number so we match picture 1_A with 1
#orderR = np.argsort([int((p.split('_')[-1]).split('.')[0]) for p in video_fi
#video_files = video_files[orderR]
data_files.sort()
```

In [293…
```
data_files
```

Out[293…
```
array(['Smooth_15_-2_0_4623HF_res2.p', 'Smooth_15_-2_1_QV4WNZ_res2.p',
       'Smooth_15_-2_2_JB90U4_res2.p', 'Smooth_15_-2_3_MCDNNA_res2.p',
       'Smooth_15_-2_4_VIWO2O_res2.p', 'Smooth_15_-4_0_ESS22N_res2.p',
       'Smooth_15_-4_1_8GD6QO_res2.p', 'Smooth_15_-4_2_FMBNMX_res2.p',
       'Smooth_15_-4_3_EEUONU_res2.p', 'Smooth_15_-4_4_64CXH3_res2.p',
       'Smooth_15_-6_0_2HDNNZ_res2.p', 'Smooth_15_-6_1_D23FV7_res2.p',
       'Smooth_15_-6_2_U8BJY4_res2.p', 'Smooth_15_-6_3_GK86VH_res2.p',
       'Smooth_15_-6_4_JU8DFH_res2.p', 'Smooth_15_0_0_D26LA1_res2.p',
       'Smooth_15_0_1_OOBKBZ_res2.p', 'Smooth_15_0_2_MNBSLT_res2.p',
       'Smooth_15_0_3_VY12DF_res2.p', 'Smooth_15_0_4_46CIDO_res2.p',
       'Smooth_30_-2_0_07HKRJ_res2.p', 'Smooth_30_-2_1_UA678T_res2.p',
       'Smooth_30_-2_2_Z2CEPT_res2.p', 'Smooth_30_-2_3_DPNF63_res2.p',
       'Smooth_30_-2_4_O2G6SZ_res2.p', 'Smooth_30_-4_0_9WKFQF_res2.p',
       'Smooth_30_-4_1_B6QVWT_res2.p', 'Smooth_30_-4_2_9YG7KZ_res2.p',
       'Smooth_30_-4_3_ZZ3YEH_res2.p', 'Smooth_30_-4_4_ARXESZ_res2.p',
       'Smooth_30_-6_0_HOA2A3_res2.p', 'Smooth_30_-6_1_2F304V_res2.p',
       'Smooth_30_-6_2_R5OVIS_res2.p', 'Smooth_30_-6_3_7A1JE7_res2.p',
       'Smooth_30_-6_4_YKIR3Y_res2.p', 'Smooth_30_0_0_TOWEUT_res2.p',
       'Smooth_30_0_1_RB5B21_res2.p', 'Smooth_30_0_2_AAU13M_res2.p',
       'Smooth_30_0_3_STATJY_res2.p', 'Smooth_30_0_4_YKCRBC_res2.p',
       'Smooth_45_-2_0_3P4T66_res2.p', 'Smooth_45_-2_1_JFT8WZ_res2.p',
       'Smooth_45_-2_2_XM1ETY_res2.p', 'Smooth_45_-2_3_BR9Z93_res2.p',
       'Smooth_45_-2_4_OZMRTY_res2.p', 'Smooth_45_-4_0_GNGX25_res2.p',
       'Smooth_45_-4_1_DPV5FD_res2.p', 'Smooth_45_-4_2_BZ37KH_res2.p',
       'Smooth_45_-4_3_GRNIXW_res2.p', 'Smooth_45_-4_4_810HRV_res2.p',
       'Smooth_45_-6_0_R378Z4_res2.p', 'Smooth_45_-6_1_0NECPK_res2.p',
       'Smooth_45_-6_2_U2KIG0_res2.p', 'Smooth_45_-6_3_9UF74H_res2.p',
       'Smooth_45_-6_4_WAKIAQ_res2.p', 'Smooth_45_0_0_V4SN9S_res2.p',
       'Smooth_45_0_1_IGTHOY_res2.p', 'Smooth_45_0_2_B8A482_res2.p',
       'Smooth_45_0_3_9GBKOP_res2.p', 'Smooth_45_0_4_SLPA8L_res2.p',
       'Smooth_60_-2_0_EENTSE_res2.p', 'Smooth_60_-2_1_TOLJ0V_res2.p',
       'Smooth_60_-2_2_QJP3WV_res2.p', 'Smooth_60_-2_3_C9X5WP_res2.p',
       'Smooth_60_-2_4_UX8ITL_res2.p', 'Smooth_60_-4_0_EVQ115_res2.p',
       'Smooth_60_-4_1_9CNJ4F_res2.p', 'Smooth_60_-4_2_XJTK3X_res2.p',
       'Smooth_60_-4_3_DDB2LK_res2.p', 'Smooth_60_-4_4_PPJSIF_res2.p',
       'Smooth_60_-6_0_EO5Q0F_res2.p', 'Smooth_60_-6_1_ITFYF8_res2.p',
       'Smooth_60_-6_2_P77OMH_res2.p', 'Smooth_60_-6_3_HY8MRS_res2.p',
       'Smooth_60_-6_4_ONJJEZ_res2.p', 'Smooth_60_0_0_6KASLJ_res2.p',
       'Smooth_60_0_1_H2CBPV_res2.p', 'Smooth_60_0_2_HI1FZ4_res2.p',
       'Smooth_60_0_3_0IMBF0_res2.p', 'Smooth_60_0_4_XV9Y0W_res2.p'],
      dtype='<U28')
```

In [294…
```
# grab one 60mm/s 0deg/s file
file_name = 'Smooth_30_-6_4_YKIR3Y_res2.p'

# load the result file
res = pickle.load(open('{}{}'.format(datadir, file_name), 'rb'))
```

In [295…
```
res
```

Out[295…

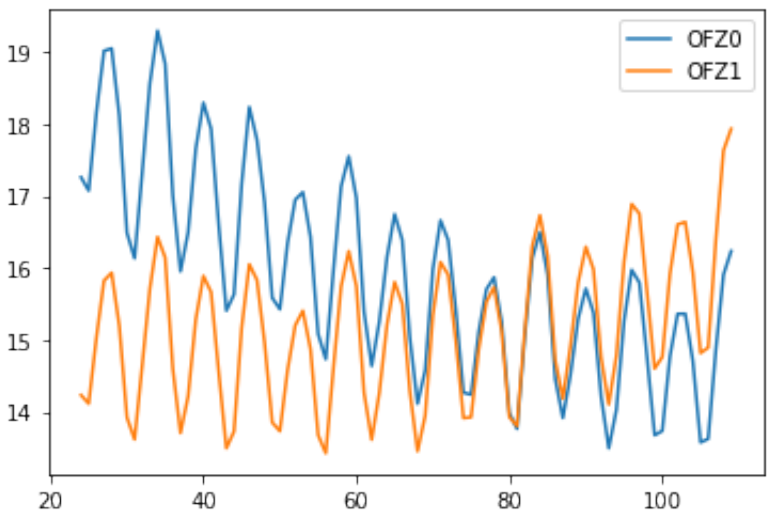
	AM0	AM1	AM2	AM3	AM4	AM5	AM6
24	NaN	NaN	[712.5593, 1915.6863]	[1517.2888, 1848.7424]	[2188.1787, 1792.2988]	NaN	NaN
25	NaN	NaN	[728.36206, 1914.0105]	[1531.2812, 1848.8696]	[2202.186, 1793.5519]	NaN	NaN
26	NaN	NaN	[746.6434, 1912.5315]	[1547.0874, 1849.1243]	[2217.25, 1795.5]	NaN	NaN
27	NaN	NaN	[763.1866, 1910.5607]	[1562.5529, 1849.222]	[2233.6843, 1796.5732]	NaN	NaN
28	NaN	NaN	[783.10187, 1908.5262]	[1578.0094, 1849.4556]	[2249.59, 1798.3641]	NaN	NaN
…	…	…	…	…	…	…	…
105	[469.88364, 1777.1495]	[1189.2173, 1845.5721]	[1950.9946, 1907.3301]	[2779.1882, 1980.6411]	NaN	[864.55566, 1078.0225]	[1413.3021, 1106.8596]
106	[485.6576, 1775.7463]	[1203.2563, 1845.4536]	[1965.2244, 1908.7026]	[2795.9302, 1983.7627]	NaN	[878.891, 1078.1571]	[1426.8787, 1107.3246]
107	[504.5831, 1774.2732]	[1220.2512, 1845.7722]	[1981.5148, 1910.3546]	[2815.5356, 1987.7056]	NaN	[895.06616, 1078.2604]	[1442.1499, 1107.6945]
108	[523.7474, 1772.771]	[1236.4143, 1845.5518]	[1998.1643, 1911.9368]	[2834.6206, 1991.6497]	NaN	[912.33887, 1078.4443]	[1458.0509, 1108.3832]
109	[542.4555, 1771.011]	[1252.9152, 1845.4683]	[2015.2817, 1913.8981]	[2854.021, 1995.3582]	NaN	[930.3812, 1078.6333]	[1474.9763, 1108.7538]

86 rows × 27 columns

In [296…

```
res[['OFZ0', 'OFZ1']].plot()
```

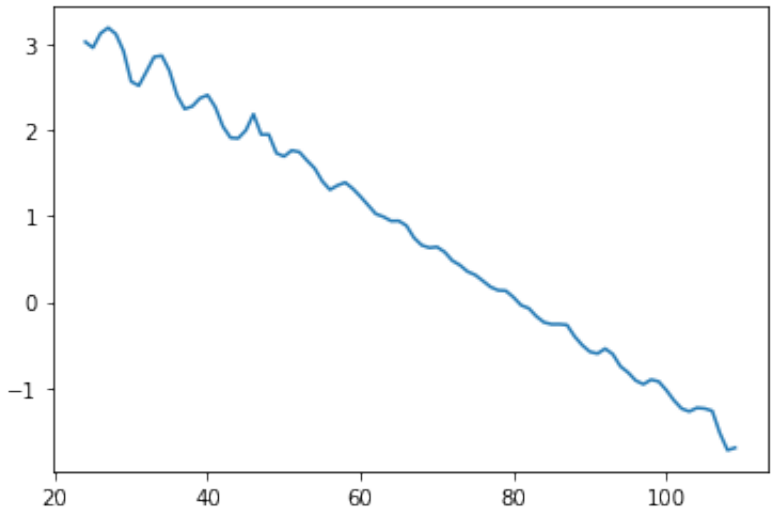
Out[296… <AxesSubplot:>



In [ ]:

In [297…
```
(res['OFZ0'] - res[ 'OFZ1']).plot()
```

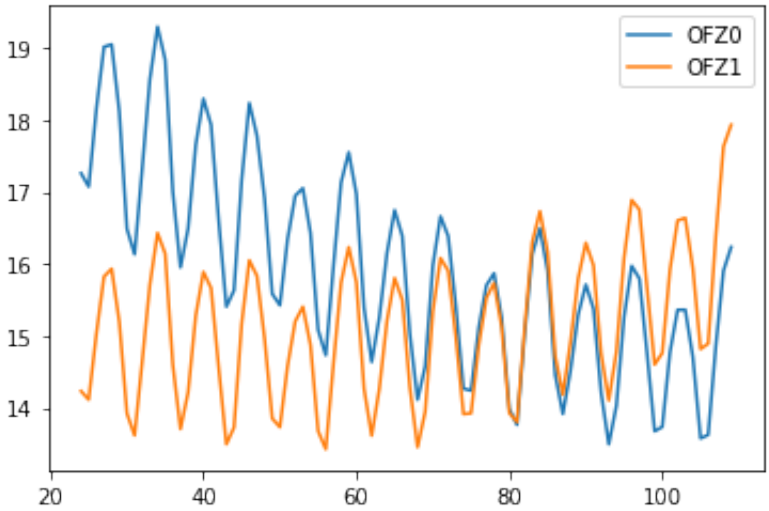
Out[297… <AxesSubplot:>



In [298…
```
# correct for rotation
rot_vel = -6

# number of pixels per degree/s of rotation
rotational_coeff = 2.24  #2.10661689
```

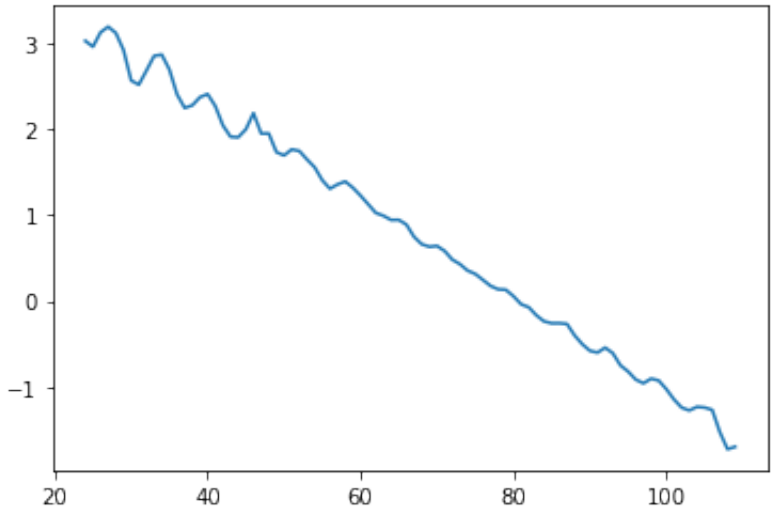
In [299…
```
res[['OFZ0', 'OFZ1']].plot()
```

Out[299… <AxesSubplot:>



In [300…
```
(res['OFZ0'] - res['OFZ1']).plot()
```

Out[300… <AxesSubplot:>



In [301…
```
frame_x = 3264
mid_frame_x = 3264/2
```

In [302…
```
# Get x positions of the centers

for zone in range(6):
    res['OFZ{}x'.format(zone)] = res['OFC{}'.format(zone)].apply(lambda x: x[

res.columns
```

Out[302…
```
Index(['AM0', 'AM1', 'AM2', 'AM3', 'AM4', 'AM5', 'AM6', 'AM7', 'AM8', 'AM9',
       'AM10', 'AM11', 'AM12', 'AM13', 'AM14', 'OFC0', 'OFC1', 'OFC2', 'OFC3',
       'OFC4', 'OFC5', 'OFZ0', 'OFZ1', 'OFZ2', 'OFZ3', 'OFZ4', 'OFZ5', 'OFZ0x'
,
       'OFZ1x', 'OFZ2x', 'OFZ3x', 'OFZ4x', 'OFZ5x'],
      dtype='object')
```

In [303…
```
res.columns[res.columns.str.contains('OFC')]
```

Out[303…
```
Index(['OFC0', 'OFC1', 'OFC2', 'OFC3', 'OFC4', 'OFC5'], dtype='object')
```

In [304…
```
# find the "real" OF by looking at the frames around where OFZ0 == OFZ1
```

In [305…
```
res[(res.index>71)&(res.index<91)][['OFZ0', 'OFZ1']]
```

Out[305…

	OFZ0	OFZ1
72	16.385429	15.904581
73	15.419061	14.991177
74	14.267649	13.914384
75	14.240088	13.926067
76	15.115617	14.870044
77	15.702347	15.527748
78	15.868148	15.732862
79	15.248645	15.118854
80	13.983316	13.928537
81	13.765169	13.803653
82	15.025556	15.099536
83	16.134418	16.302422
84	16.492929	16.730350
85	15.906035	16.166265
86	14.457864	14.717233
87	13.916199	14.183848
88	14.519905	14.921288
89	15.294028	15.797721
90	15.711791	16.292051

In [306…

```
res[(res.index>71)&(res.index<91)].mean()
```

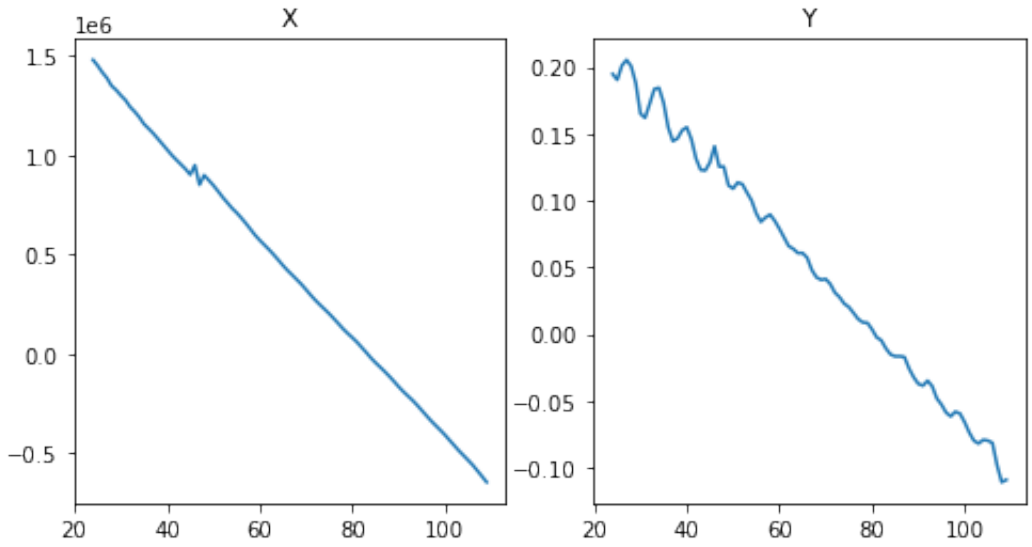
Out[306…
```
AM0       188.933777
AM1       817.243164
AM2      1594.032593
AM3      2379.047607
AM4      3007.163574
AM5       464.188385
AM6      1050.187134
AM7      1632.540649
AM8      2216.443359
AM9      2800.926025
AM10      628.807983
AM11     1099.125244
AM12     1566.935547
AM13     2029.054688
AM14     2484.333496
OFC0     1205.637817
OFC1     1986.540039
OFC2     1341.363892
OFC3     1924.492188
OFC4     1333.030273
OFC5     1797.995239
OFZ0       15.129168
OFZ1       15.154138
OFZ2       15.031046
OFZ3       15.102635
OFZ4       15.039822
OFZ5       14.948513
OFZ0x    -426.362131
OFZ1x     354.540103
OFZ2x    -290.635961
OFZ3x     292.492033
OFZ4x    -298.969604
OFZ5x     165.995304
dtype: float64
```

In [307…
```
OFactual = res.mean()[['OFZ0','OFZ1']].mean()
OFactual
```

Out[307…
```
15.537654965422874
```

In [308…
```
# Check zone 0 and 1

y = (res['OFZ0'] - res['OFZ1'])/OFactual

x = (res['OFZ0x']*res['OFZ0x'] - res['OFZ1x']*res['OFZ1x'])
```

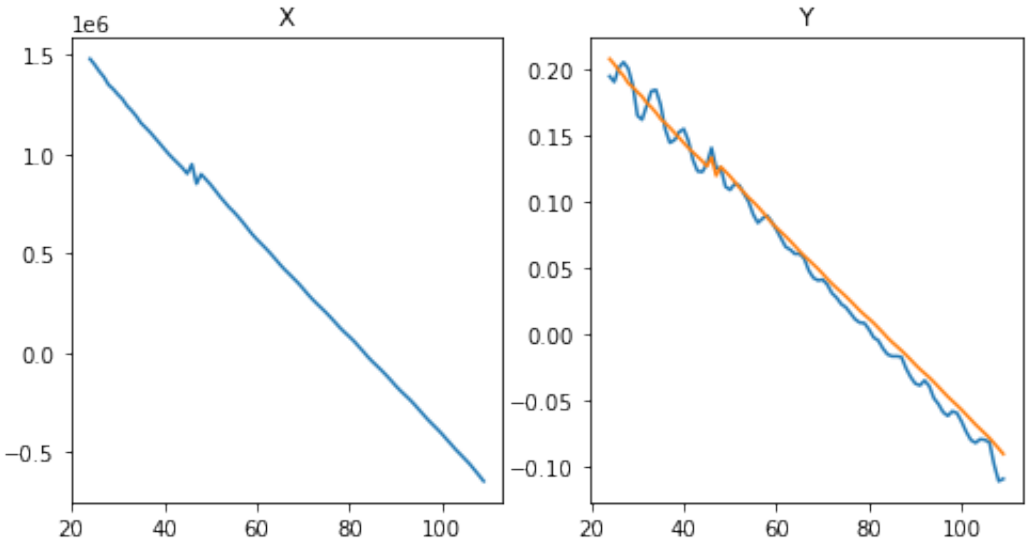
In [309…
```
fix, ax = plt.subplots(1,2, figsize=(8, 4))
ax[0].plot(x)
ax[0].set_title('X')
ax[1].plot(y)
ax[1].set_title('Y')
plt.show()
```



In [310…

```
degrees = [1]       # list of degrees of x to use
matrix = np.stack([x**d for d in degrees], axis=-1)   # stack them like colum
coeff = np.linalg.lstsq(matrix, y)[0]    # lstsq returns some additional info
print("Coefficients", coeff)
fit = np.dot(matrix, coeff)


fix, ax = plt.subplots(1,2, figsize=(8, 4))
ax[0].plot(x)
ax[0].set_title('X')
ax[1].plot(y)
ax[1].plot(y.index,fit)


ax[1].set_title('Y')
plt.show()
```

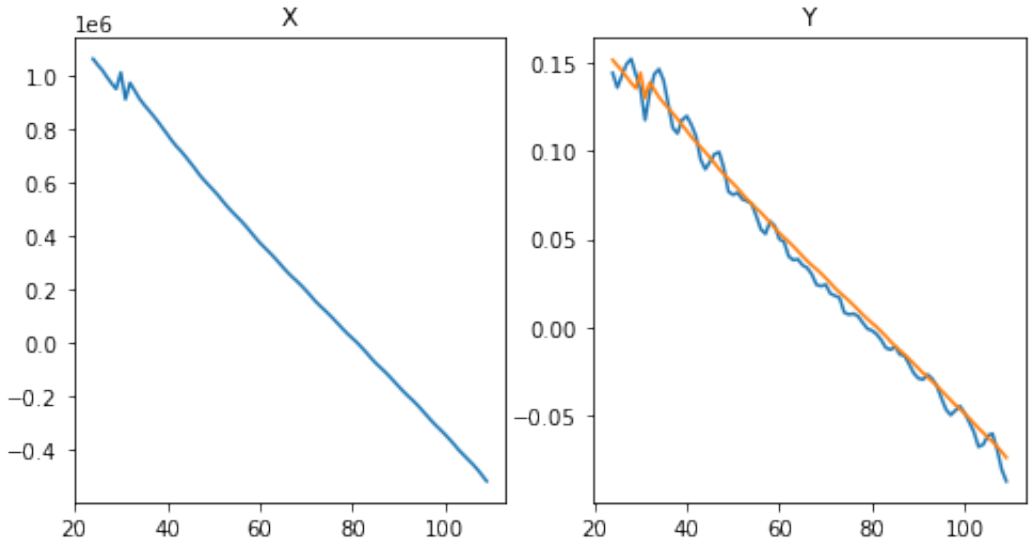
```
Coefficients [1.40440219e-07]
<ipython-input-310-bd8d045d6b49>:3: FutureWarning: `rcond` parameter will chan
ge to the default of machine precision times ``max(M, N)`` where M and N are t
he input matrix dimensions.
To use the future default and silence this warning we advise to pass `rcond=No
ne`, to keep using the old, explicitly pass `rcond=-1`.
  coeff = np.linalg.lstsq(matrix, y)[0]    # lstsq returns some additional inf
o we ignore
```



In [311…

```
# Check zone 0 and 1
z1 = 2
z2 = 3
y = (res['OFZ{}'.format(z1)] - res['OFZ{}'.format(z2)])/OFactual

x = (res['OFZ{}x'.format(z1)]*res['OFZ{}x'.format(z1)] - res['OFZ{}x'.format(

degrees = [1]       # list of degrees of x to use
matrix = np.stack([x**d for d in degrees], axis=-1)   # stack them like colum
coeff = np.linalg.lstsq(matrix, y)[0]    # lstsq returns some additional info
print("Coefficients", coeff)
fit = np.dot(matrix, coeff)


fix, ax = plt.subplots(1,2, figsize=(8, 4))
ax[0].plot(x)
ax[0].set_title('X')
ax[1].plot(y)
ax[1].plot(y.index,fit)


ax[1].set_title('Y')
plt.show()
```

```
<ipython-input-311-6734be5089d3>:10: FutureWarning: `rcond` parameter will cha
nge to the default of machine precision times ``max(M, N)`` where M and N are
the input matrix dimensions.
To use the future default and silence this warning we advise to pass `rcond=No
ne`, to keep using the old, explicitly pass `rcond=-1`.
  coeff = np.linalg.lstsq(matrix, y)[0]    # lstsq returns some additional inf
o we ignore
Coefficients [1.42214987e-07]
```



In [312…
```
# camera parameters
f = 3.04
chip = 3.68
resolution = 3264
```

In [313…
```
i=0
np.max(1./np.power(np.cos(np.arctan((res['OFZ{}x'.format(i)]*chip/resolution)
```

Out[313…
```
1.2403162987735674
```

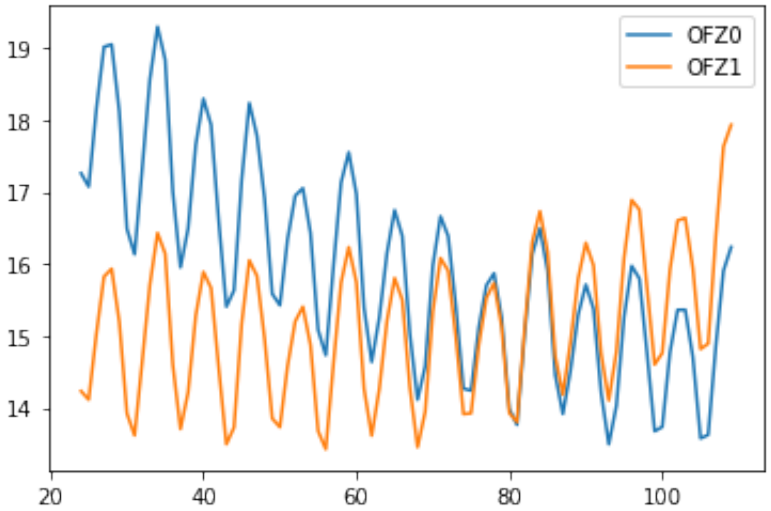
In [315…
```
rotational_coeff = 2.24
```

In [340…
```
for i in range(6):
    res['OFZLinear{}'.format(i)] = (res['OFZ{}'.format(i)] +
                                    rotational_coeff*rot_vel/
                                    (np.power(np.cos(np.arctan((1.15*res['OFZ
```

res['OFZLinear{}'.format(i)] = (res['OFZ{}'.format(i)] + rotational_coeff*rot_vel/ (1.40440219e-07*res['OFZ{}x'.format(i)]*res['OFZ{}x'.format(i)]+1.))

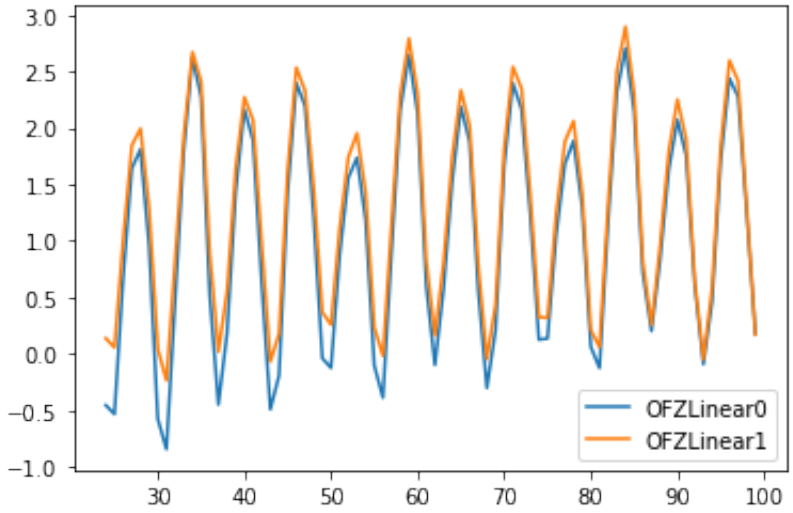
In [341…
```
res[['OFZ0', 'OFZ1']].plot()
```

Out[341… <AxesSubplot:>



In [342…
```
res[['OFZLinear0', 'OFZLinear1']][:-10].plot()
```

Out[342… <AxesSubplot:>



Try this out on a new file

Use one with different optical flow speeds

In [347…
```
# grab one 60mm/s 0deg/s file
file_name = 'Smooth_30_-2_4_O2G6SZ_res2.p'

# load the result file
res = pickle.load(open('{}{}'.format(datadir, file_name), 'rb'))
```

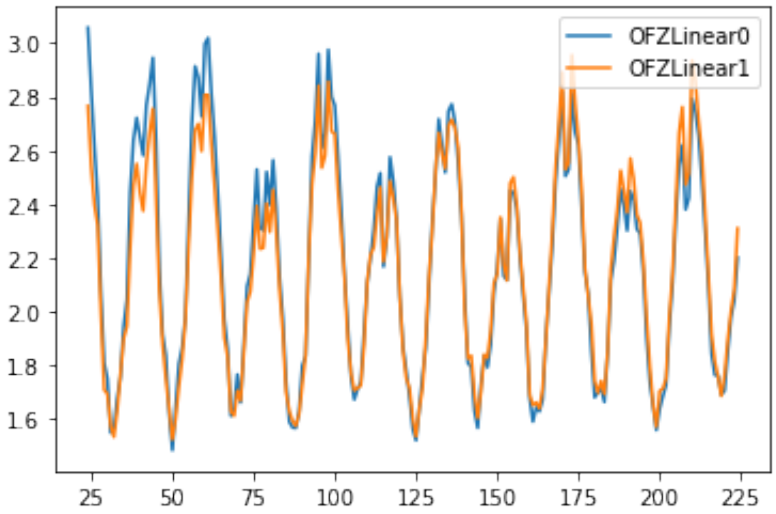
In [348…

```
# correct for rotation
rot_vel = -2

# Get x positions of the centers

for zone in range(6):
    res['OFZ{}x'.format(zone)] = res['OFC{}'.format(zone)].apply(lambda x: x[




for zone in range(6):
    res['OFZLinear{}'.format(zone)] = (res['OFZ{}'.format(zone)] +
                                       rotational_coeff*rot_vel/
                                       (np.power(np.cos(np.arctan((1.15*res['OFZ
```

In [349…

```
res[['OFZLinear0', 'OFZLinear1']].plot()
```

Out[349… <AxesSubplot:>



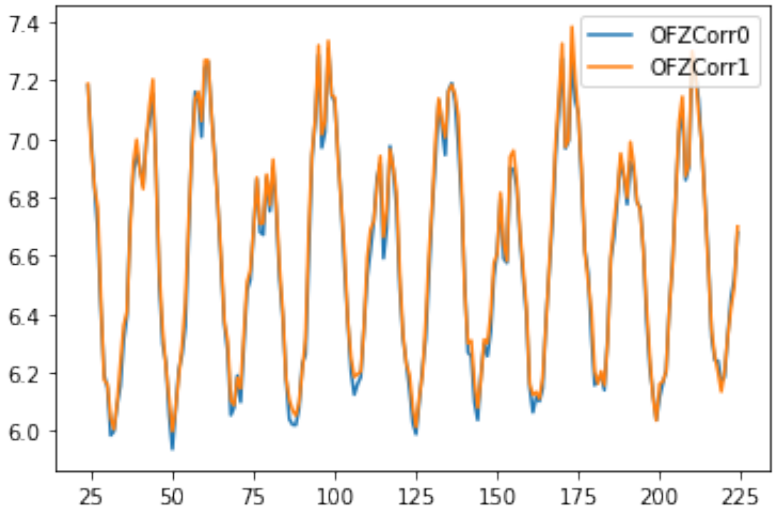
In [ ]:

```
# Get x positions of the centers


for zone in range(6):
    res['OFZ{}x'.format(zone)] = res['OFC{}'.format(zone)].apply(lambda x: x[

for i in range(6):
    res['OFZLinear{}'.format(zone)] = res['OFZ{}'.format(zone)] + rot_coeff*r
```

In [421…

```
res[['OFZCorr0', 'OFZCorr1']].plot()
```

Out[421… <AxesSubplot:>



Create the function to iterate through all the files

In [92]:
```
file_name.split('_')
```

Out[92]: ['Smooth', '15', '-2', '0', '4623HF', 'res2.p']

In [433…
```
# camera parameters
f = 3.04
chip = 3.68
resolution = 3264
rotational_coeff=2.2
```

In [434…
```
full_rotational_coeff_result = pickle.load(open('{}{}'.format("/Users/{}/Goog
                                                'full_rotationa
```

In [435…
```
rotational_coeff = pd.Series([2.049529, 2.051370,2.160106,2.158514,2.221120,2
                              index=['OFZ0', 'OFZ1', 'OFZ2', 'OFZ3', 'OFZ4', 'O
```

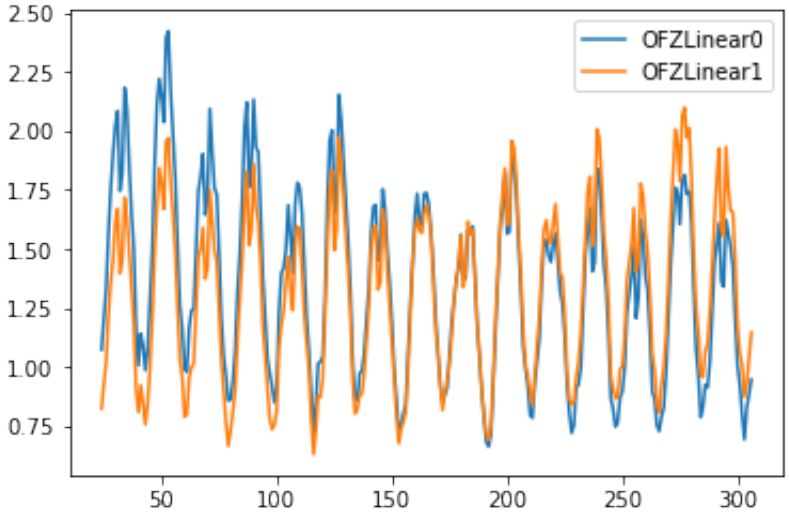
In [436…
```
rotational_coeff = full_rotational_coeff_result[['OFZ0', 'OFZ1', 'OFZ2', 'OFZ
```

In [439…

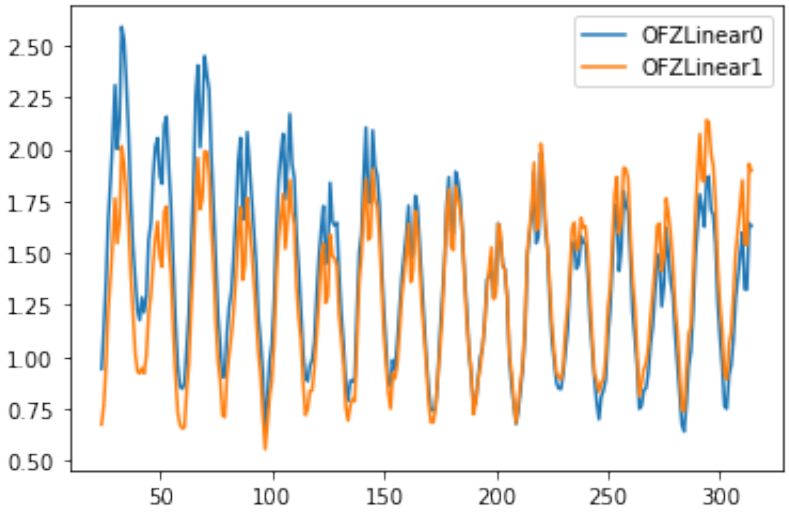
```
ff = 1.0

for file_name in data_files:
    # load the result file
    print(file_name)
    rot_vel = float(file_name.split('_')[2])
    lin_vel = float(file_name.split('_')[1])
    print('Rot_vel {} {}'.format(rot_vel, lin_vel))
    new_file_name = '{}_res3.p'.format(file_name[:-7])
    print(new_file_name)

    if True:


        res = pickle.load(open('{}{}'.format(datadir, file_name), 'rb'))
        print(res.shape)

        for zone in range(6):
            # Get x positions of the centers
            res['OFZ{}x'.format(zone)] = res['OFC{}'.format(zone)].apply(lamb

        for zone in range(6):
            res['OFZLinear{}'.format(zone)] = (res['OFZ{}'.format(zone)] +
                                               rotational_coeff['OFZ{}'.format(zone)
                                               (np.power(np.cos(np.arctan(ff*(res['O




        # remove zero OF

        res = res[res['OFZLinear0']>0][:-5]
        for i in range(3):
            Z0 = 'OFZLinear{}'.format(i*2)
            Z1 = 'OFZLinear{}'.format(i*2+1)


            print('{}-{} Avg: {} {} avg: {}  delta: {}'.format(Z0,Z1,
                                                               res[Z0].mean()
                                                           res[Z1].mean()/lin_v
                                    res[Z0].mean()/lin_vel*100-res[Z1].mean()/lin_ve
                                    (res[Z0].mean()/lin_vel*100+res[Z1].mean()/lin_v

        res[['OFZLinear0', 'OFZLinear1']].plot()
        plt.show()

        pickle.dump(res, open('{}{}'.format(datadir, new_file_name), 'wb'))
```

```
Smooth_15_-2_0_4623HF_res2.p
Rot_vel -2.0 15.0
Smooth_15_-2_0_4623HF_res3.p
(296, 27)
OFZLinear0-OFZLinear1 Avg: 9.041454197938334 8.722914633327557 avg: 0.31853956
461077715  delta: 8.882184415632945
OFZLinear2-OFZLinear3 Avg: 6.744265468624317 6.585199204820033 avg: 0.15906626
380428346  delta: 6.6647323367221745
OFZLinear4-OFZLinear5 Avg: 5.4063937942555045 5.303455354175894 avg: 0.1029384
```

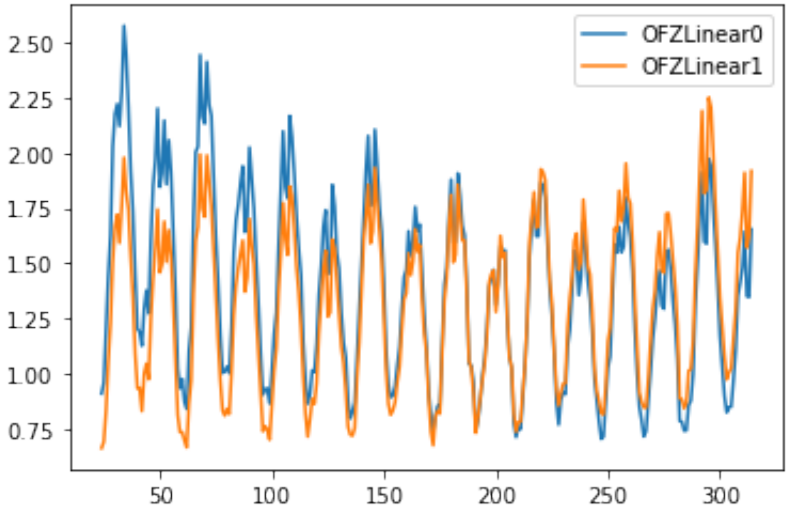
4007961006 delta: 5.3549245742156995



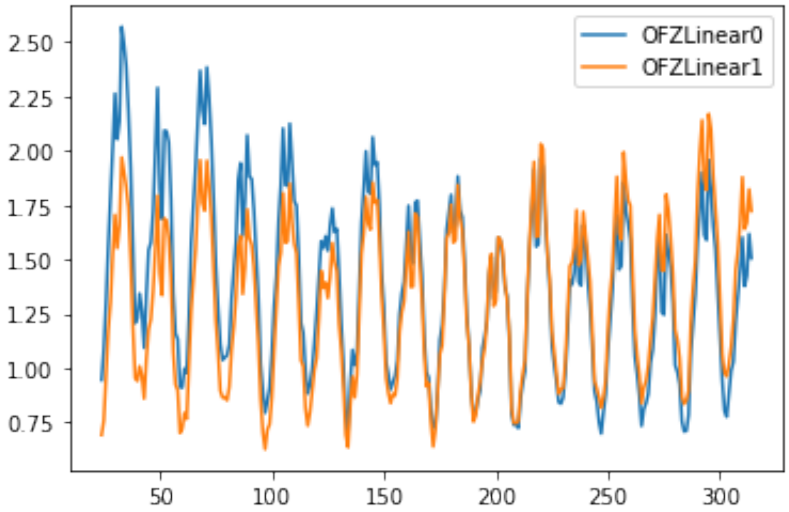
Smooth_15_-2_1_QV4WNZ_res2.p
Rot_vel -2.0 15.0
Smooth_15_-2_1_QV4WNZ_res3.p
(296, 27)
OFZLinear0-OFZLinear1 Avg: 9.2845168631696 8.759385658539312 avg: 0.5251312046302878 delta: 9.021951260854456
OFZLinear2-OFZLinear3 Avg: 6.910717455146699 6.635676470083399 avg: 0.2750409850633 delta: 6.773196962615049
OFZLinear4-OFZLinear5 Avg: 5.553281618475932 5.379808584725531 avg: 0.17347303375040113 delta: 5.466545101600731



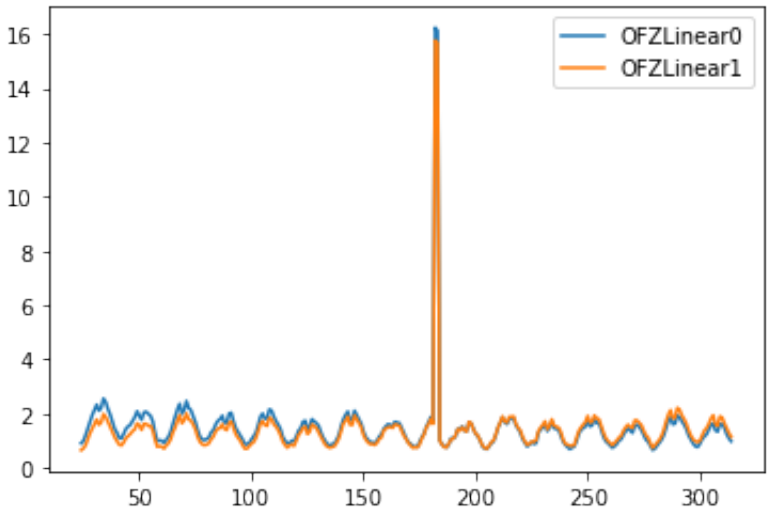
Smooth_15_-2_2_JB90U4_res2.p
Rot_vel -2.0 15.0
Smooth_15_-2_2_JB90U4_res3.p
(296, 27)
OFZLinear0-OFZLinear1 Avg: 9.270886416825533 8.73879087783635 avg: 0.5320955389891839 delta: 9.004838647330942
OFZLinear2-OFZLinear3 Avg: 6.89546113633753 6.616993773704325 avg: 0.2784673626332044 delta: 6.756227455020928
OFZLinear4-OFZLinear5 Avg: 5.539355520377363 5.36605248983194 avg: 0.17330303054542284 delta: 5.452704005104652



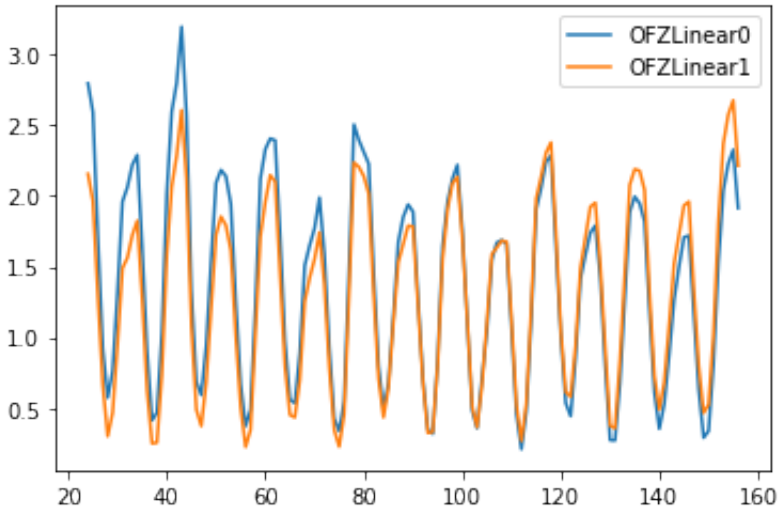

```
Smooth_15_-2_3_MCDNNA_res2.p
Rot_vel -2.0 15.0
Smooth_15_-2_3_MCDNNA_res3.p
(296, 27)
OFZLinear0-OFZLinear1 Avg: 9.275509419690813 8.747995381907577 avg: 0.52751403
77832361  delta: 9.011752400799196
OFZLinear2-OFZLinear3 Avg: 6.904402952106439 6.625304575906023 avg: 0.27909837
6200416  delta: 6.764853764006231
OFZLinear4-OFZLinear5 Avg: 5.54590969686641 5.370967734570815 avg: 0.174941962
29559478  delta: 5.4584387157186125
```



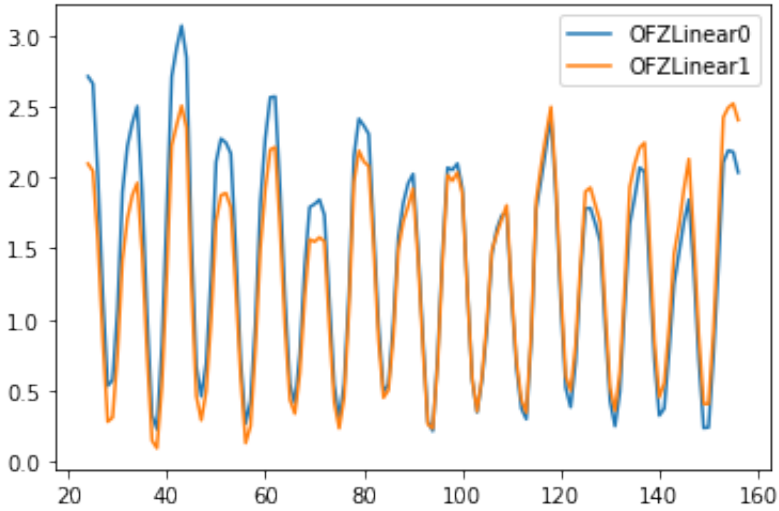

```
Smooth_15_-2_4_VIWO2O_res2.p
Rot_vel -2.0 15.0
Smooth_15_-2_4_VIWO2O_res3.p
(296, 27)
OFZLinear0-OFZLinear1 Avg: 9.902628157150156 9.379300560997418 avg: 0.52332759
61527379  delta: 9.640964359073788
OFZLinear2-OFZLinear3 Avg: 7.51585523966221 7.247572130218074 avg: 0.268283109
4441367  delta: 7.3817136849401415
OFZLinear4-OFZLinear5 Avg: 6.15487552874936 5.981219104477507 avg: 0.173656424
27185346  delta: 6.068047316613434
```



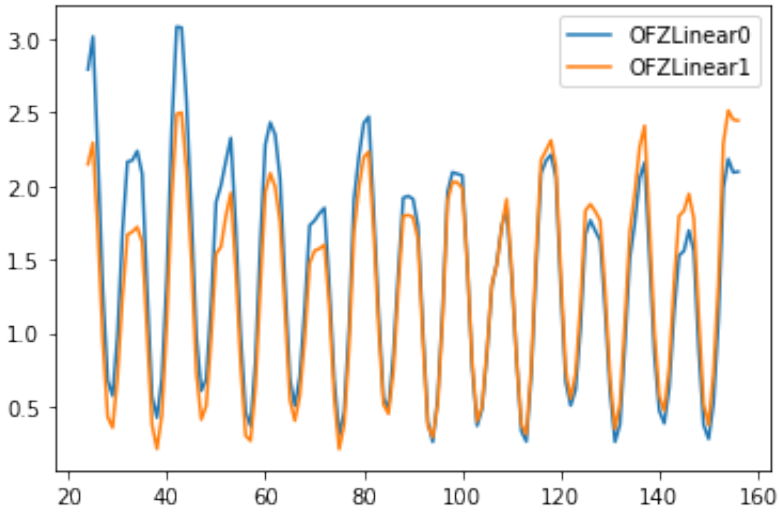

```
Smooth_15_-4_0_ESS22N_res2.p
Rot_vel -4.0 15.0
Smooth_15_-4_0_ESS22N_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.205533685241729 8.660392079529581 avg: 0.54514160
57121481  delta: 8.932962882385656
OFZLinear2-OFZLinear3 Avg: 6.923756720190749 6.629735639733739 avg: 0.29402108
04570098  delta: 6.7767461799622435
OFZLinear4-OFZLinear5 Avg: 5.605366784622709 5.428326037163925 avg: 0.17704074
74587845  delta: 5.516846410893317
```



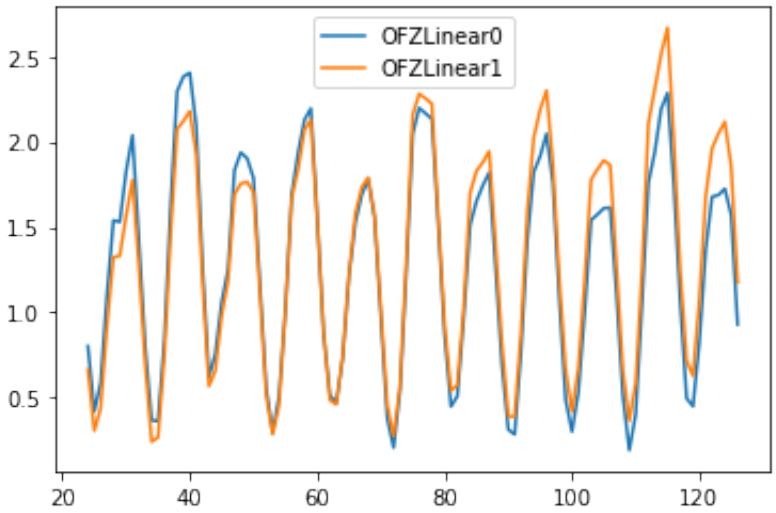

```
Smooth_15_-4_1_8GD6QO_res2.p
Rot_vel -4.0 15.0
Smooth_15_-4_1_8GD6QO_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.222928996783192 8.668269934423463 avg: 0.55465906
2359729  delta: 8.945599465603328
OFZLinear2-OFZLinear3 Avg: 6.93145356649315 6.6337726985670376 avg: 0.29768086
792611204  delta: 6.782613132530093
OFZLinear4-OFZLinear5 Avg: 5.606087853863948 5.422748009638126 avg: 0.18333984
422582184  delta: 5.514417931751037
```



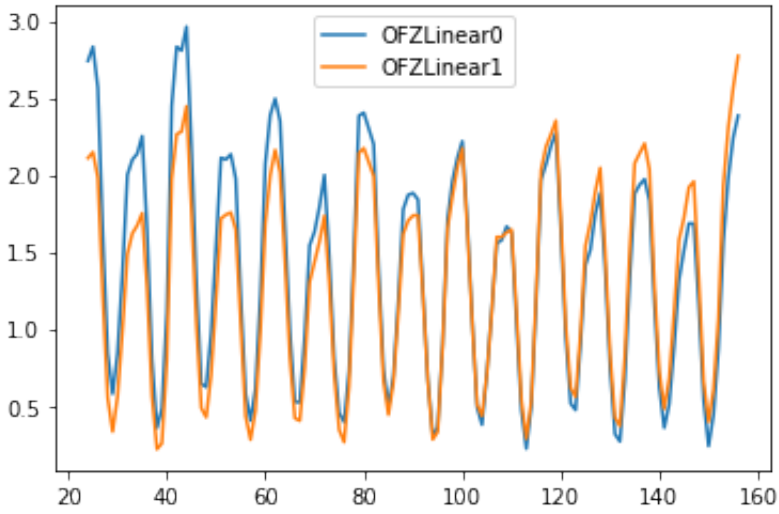

```
Smooth_15_-4_2_FMBNMX_res2.p
Rot_vel -4.0 15.0
Smooth_15_-4_2_FMBNMX_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.233095490606305 8.666979543216133 avg: 0.56611594
73901716  delta: 8.95003751691122
OFZLinear2-OFZLinear3 Avg: 6.922209253560788 6.615603582729217 avg: 0.30660567
0831571  delta: 6.7689064181450025
OFZLinear4-OFZLinear5 Avg: 5.591889652232391 5.399146533178121 avg: 0.19274311
905426966  delta: 5.495518092705256
```



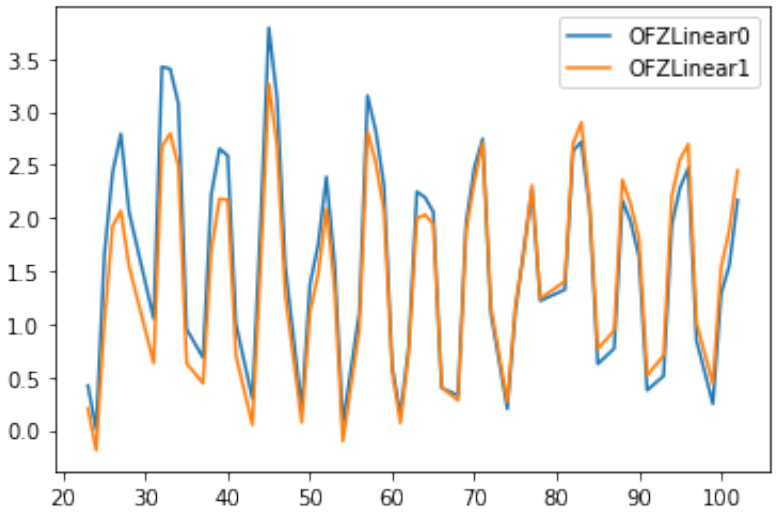

```
Smooth_15_-4_3_EEUONU_res2.p
Rot_vel -4.0 15.0
Smooth_15_-4_3_EEUONU_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 8.428729727658608 8.806169576238888 avg: -0.3774398
4858028057  delta: 8.617449651948748
OFZLinear2-OFZLinear3 Avg: 6.306744424944117 6.656331855021063 avg: -0.3495874
3007694526  delta: 6.4815381399825895
OFZLinear4-OFZLinear5 Avg: 5.028825357723568 5.2551888400628375 avg: -0.226363
48233926906  delta: 5.1420070988932025
```



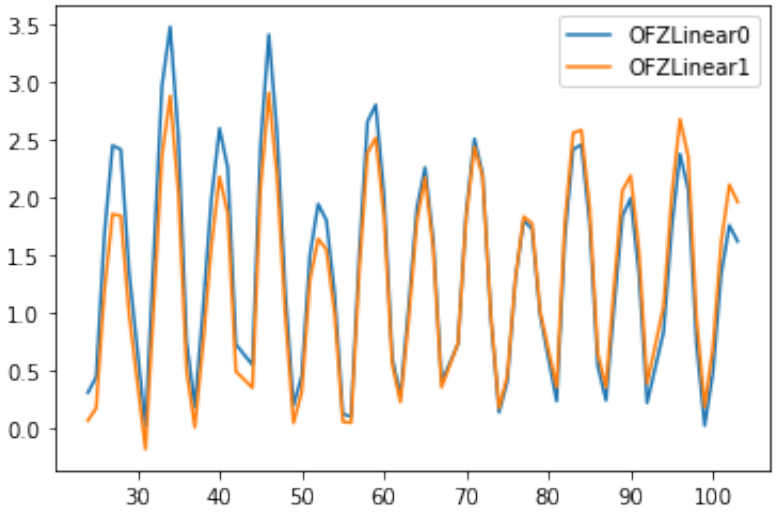

```
Smooth_15_-4_4_64CXH3_res2.p
Rot_vel -4.0 15.0
Smooth_15_-4_4_64CXH3_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.239679796751696 8.649241693930023 avg: 0.59043810
28216736  delta: 8.944460745340859
OFZLinear2-OFZLinear3 Avg: 6.922568915468365 6.599571312448847 avg: 0.32299760
301951785  delta: 6.761070113958606
OFZLinear4-OFZLinear5 Avg: 5.597673680646683 5.395772146494903 avg: 0.20190153
415178003  delta: 5.496722913570793
```



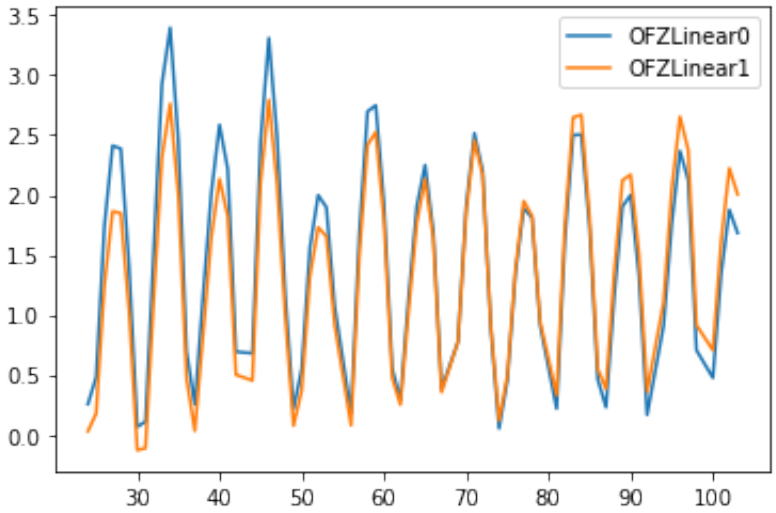

```
Smooth_15_-6_0_2HDNNZ_res2.p
Rot_vel -6.0 15.0
Smooth_15_-6_0_2HDNNZ_res3.p
(87, 27)
OFZLinear0-OFZLinear1 Avg: 11.043305440755963 10.147403562815821 avg: 0.895901
8779401422  delta: 10.595354501785891
OFZLinear2-OFZLinear3 Avg: 8.564041430133297 8.05963659989263 avg: 0.504404830
2406683  delta: 8.311839015012964
OFZLinear4-OFZLinear5 Avg: 7.099660780840342 6.769958158091925 avg: 0.32970262
274841655  delta: 6.934809469466133
```



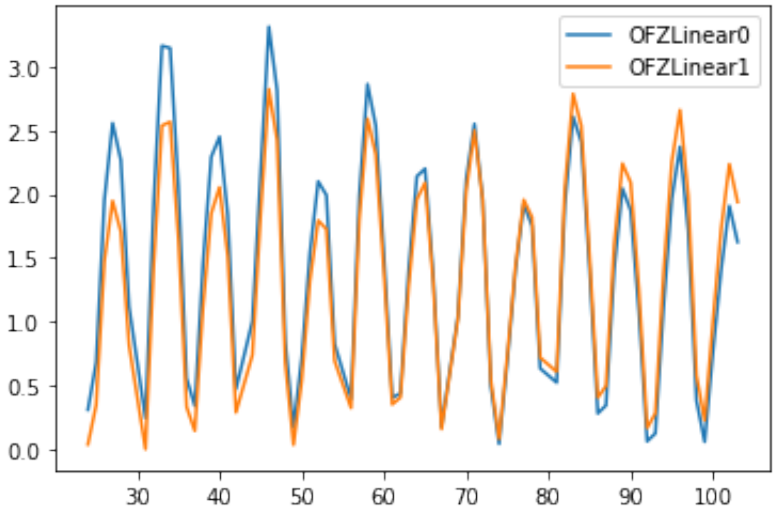

```
Smooth_15_-6_1_D23FV7_res2.p
Rot_vel -6.0 15.0
Smooth_15_-6_1_D23FV7_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.520938607231669 8.905055684002786 avg: 0.61588292
32288827  delta: 9.212997145617226
OFZLinear2-OFZLinear3 Avg: 7.164650343357143 6.857420409350251 avg: 0.30722993
40068918  delta: 7.011035376353696
OFZLinear4-OFZLinear5 Avg: 5.800018077760924 5.614486318703802 avg: 0.18553175
905712127  delta: 5.7072521982323625
```



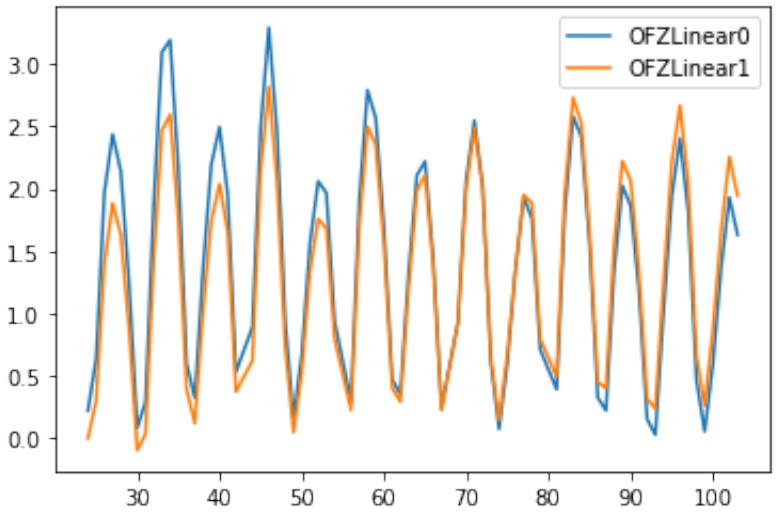

```
Smooth_15_-6_2_U8BJY4_res2.p
Rot_vel -6.0 15.0
Smooth_15_-6_2_U8BJY4_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.677699581734336 9.026723336503615 avg: 0.65097624
52307211  delta: 9.352211459118976
OFZLinear2-OFZLinear3 Avg: 7.306524007451379 6.976805853352509 avg: 0.32971815
40988694  delta: 7.141664930401944
OFZLinear4-OFZLinear5 Avg: 5.946561724772552 5.748944278629826 avg: 0.19761744
614272647  delta: 5.847753001701189
```



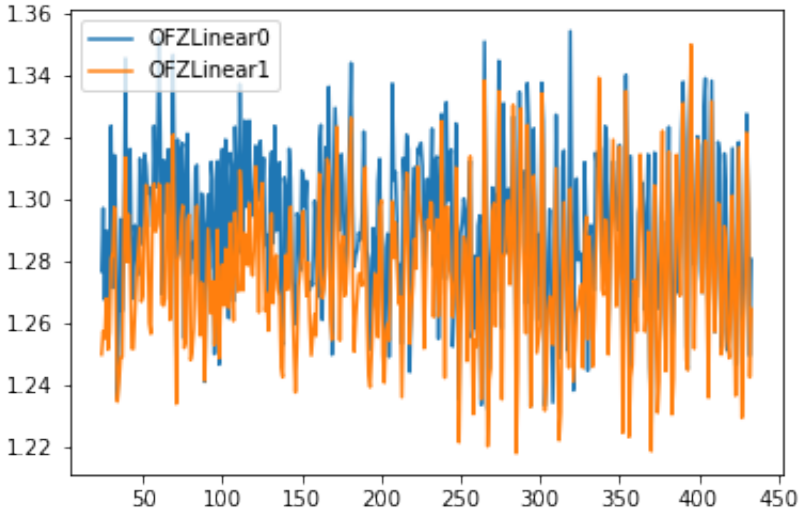

```
Smooth_15_-6_3_GK86VH_res2.p
Rot_vel -6.0 15.0
Smooth_15_-6_3_GK86VH_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.56566788439845 8.981985284440578 avg: 0.583682599
9578732  delta: 9.273826584419513
OFZLinear2-OFZLinear3 Avg: 7.232275823392932 6.925526780607311 avg: 0.30674904
27856212  delta: 7.078901302000121
OFZLinear4-OFZLinear5 Avg: 5.886081179577347 5.698956909511806 avg: 0.18712427
006554044  delta: 5.7925190445445764
```



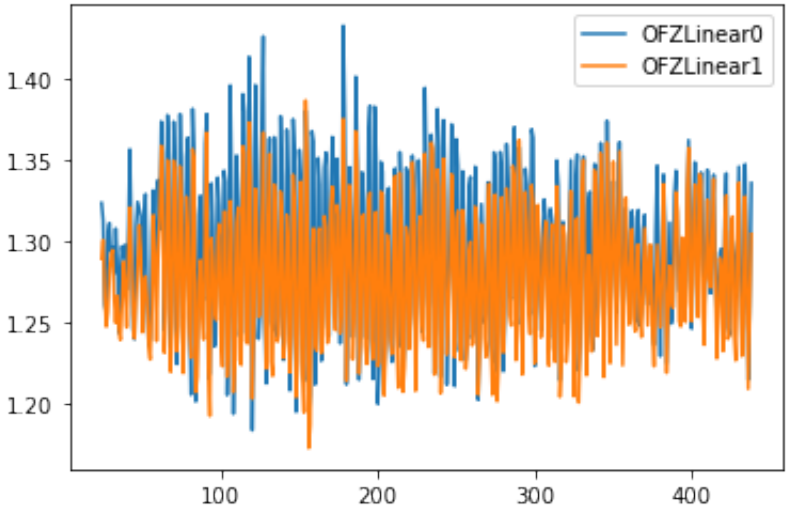

```
Smooth_15_-6_4_JU8DFH_res2.p
Rot_vel -6.0 15.0
Smooth_15_-6_4_JU8DFH_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.41924065579168 8.832656887297107 avg: 0.586583768
4945738  delta: 9.125948771544394
OFZLinear2-OFZLinear3 Avg: 7.095148944298285 6.77672706669722 avg: 0.318421877
60106455  delta: 6.935938005497753
OFZLinear4-OFZLinear5 Avg: 5.740684187930923 5.558494500458525 avg: 0.18218968
747239828  delta: 5.649589344194724
```



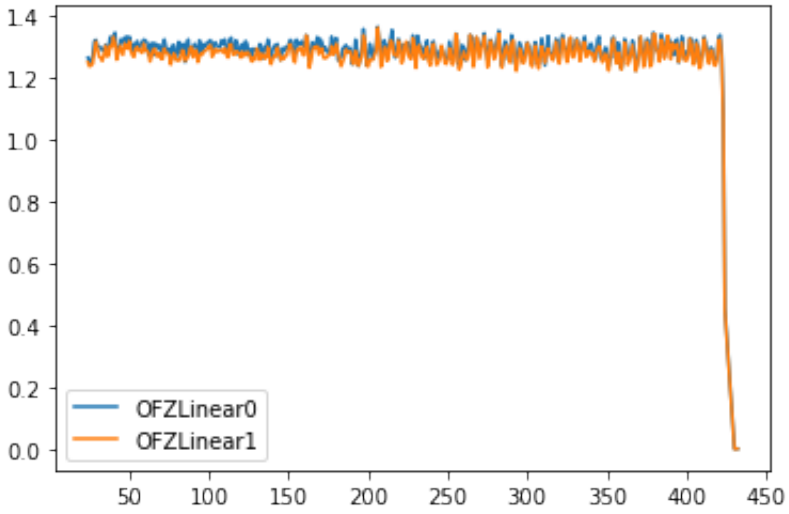

```
Smooth_15_0_0_D26LA1_res2.p
Rot_vel 0.0 15.0
Smooth_15_0_0_D26LA1_res3.p
(420, 27)
OFZLinear0-OFZLinear1 Avg: 8.612375668393886 8.509343486491257 avg: 0.10303218
190262875  delta: 8.56085957744257
OFZLinear2-OFZLinear3 Avg: 6.462773482004801 6.420317807817846 avg: 0.04245567
418695462  delta: 6.441545644911324
OFZLinear4-OFZLinear5 Avg: 5.198687367322967 5.162324459572149 avg: 0.03636290
7750818074  delta: 5.180505913447558
```



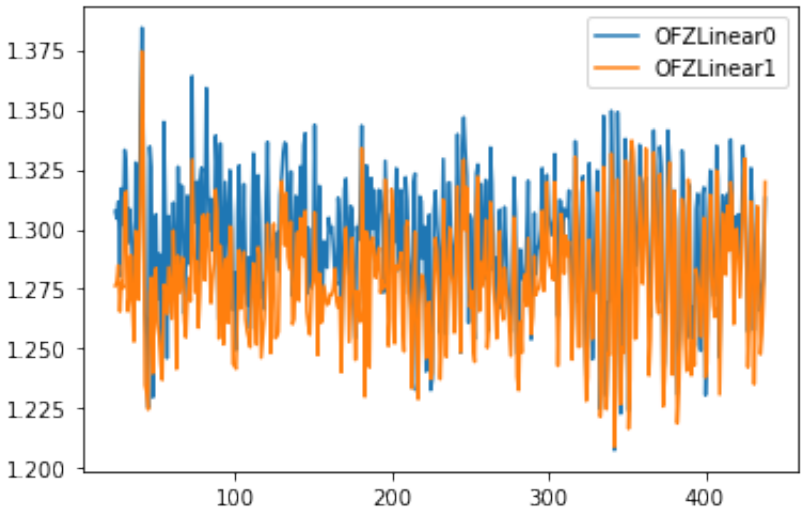

```
Smooth_15_0_1_OOBKBZ_res2.p
Rot_vel 0.0 15.0
Smooth_15_0_1_OOBKBZ_res3.p
(420, 27)
OFZLinear0-OFZLinear1 Avg: 8.624482535932916 8.520881243020176 avg: 0.10360129
291274056  delta: 8.572681889476545
OFZLinear2-OFZLinear3 Avg: 6.467604146903777 6.42551941660992 avg: 0.042084730
29385651  delta: 6.446561781756849
OFZLinear4-OFZLinear5 Avg: 5.201013049926145 5.165073516378441 avg: 0.03593953
354770374  delta: 5.183043283152292
```



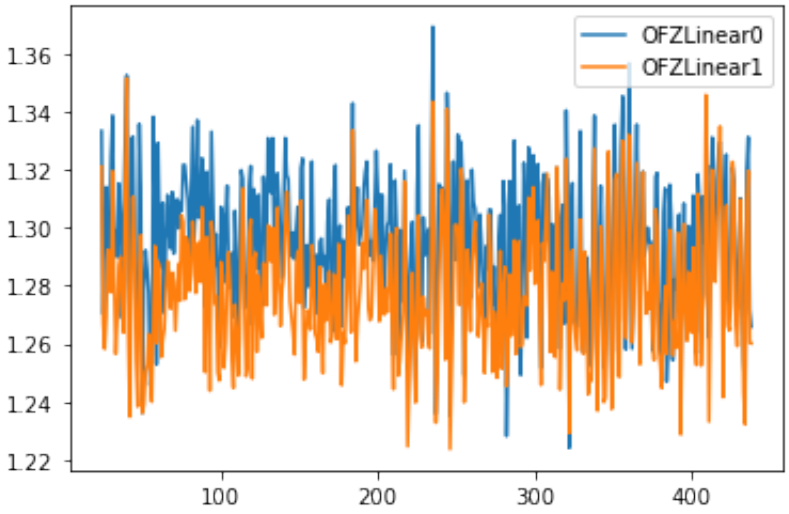

```
Smooth_15_0_2_MNBSLT_res2.p
Rot_vel 0.0 15.0
Smooth_15_0_2_MNBSLT_res3.p
(420, 27)
OFZLinear0-OFZLinear1 Avg: 8.547751948057034 8.442507607452402 avg: 0.10524434
06046315  delta: 8.495129777754718
OFZLinear2-OFZLinear3 Avg: 6.409828377492448 6.367580826433304 avg: 0.04224755
1059143795  delta: 6.388704601962877
OFZLinear4-OFZLinear5 Avg: 5.154598858153674 5.120418384391603 avg: 0.03418047
376207145  delta: 5.137508621272639
```



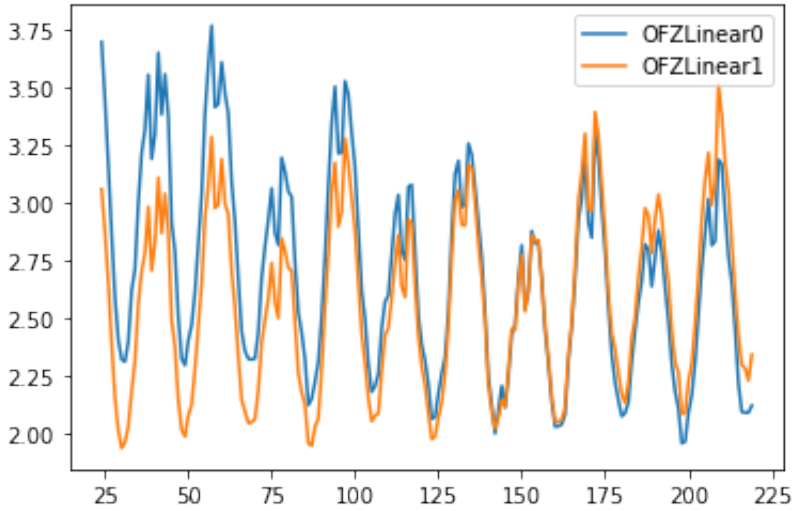

```
Smooth_15_0_3_VY12DF_res2.p
Rot_vel 0.0 15.0
Smooth_15_0_3_VY12DF_res3.p
(420, 27)
OFZLinear0-OFZLinear1 Avg: 8.632591010097519 8.521666953841365 avg: 0.11092405
62561542  delta: 8.577128981969441
OFZLinear2-OFZLinear3 Avg: 6.467432617662422 6.422752488569083 avg: 0.04468012
909333918  delta: 6.445092553115753
OFZLinear4-OFZLinear5 Avg: 5.200915020632457 5.163705645794849 avg: 0.03720937
483760789  delta: 5.182310333213653
```



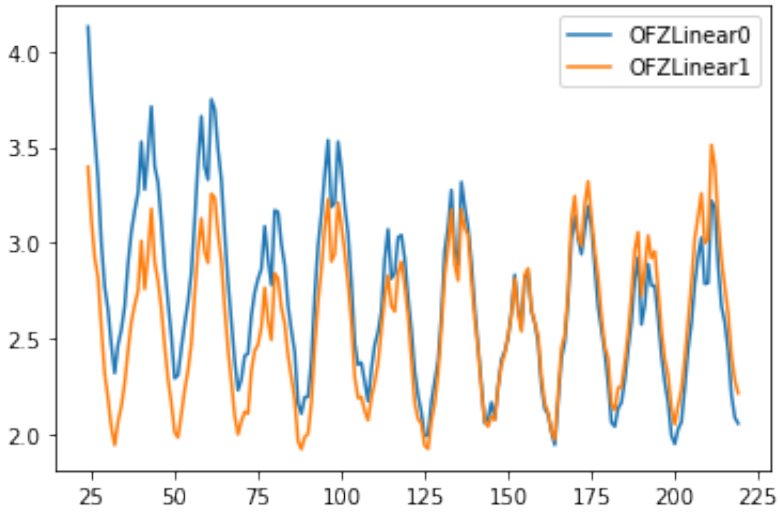

```
Smooth_15_0_4_46CIDO_res2.p
Rot_vel 0.0 15.0
Smooth_15_0_4_46CIDO_res3.p
(420, 27)
OFZLinear0-OFZLinear1 Avg: 8.636153546681843 8.524160011705147 avg: 0.11199353
497669584  delta: 8.580156779193494
OFZLinear2-OFZLinear3 Avg: 6.4710884362339485 6.4248292120584996 avg: 0.046259
22417544892  delta: 6.447958824146224
OFZLinear4-OFZLinear5 Avg: 5.204185421687053 5.165504353113442 avg: 0.03868106
85736112  delta: 5.1848448874002475
```



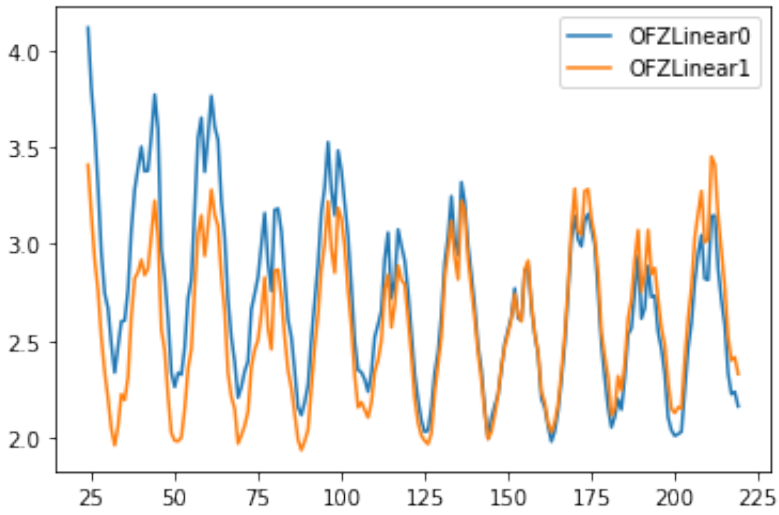

```
Smooth_30_-2_0_07HKRJ_res2.p
Rot_vel -2.0 30.0
Smooth_30_-2_0_07HKRJ_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.993832619357347 8.56738952108423 avg: 0.426443098
27311666  delta: 8.78061107022079
OFZLinear2-OFZLinear3 Avg: 6.6913530604177875 6.45769555650927 avg: 0.23365750
390851758  delta: 6.574524308463529
OFZLinear4-OFZLinear5 Avg: 5.3681487257343345 5.2138393870647555 avg: 0.154309
33866957908  delta: 5.290994056399545
```



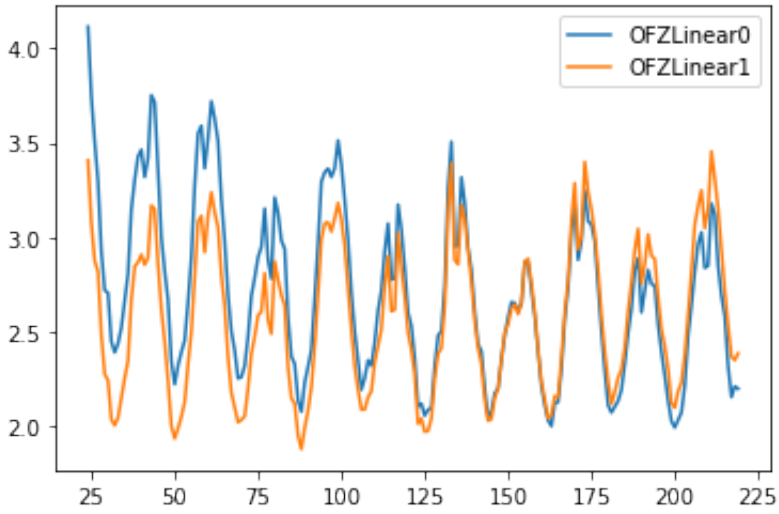

```
Smooth_30_-2_1_UA678T_res2.p
Rot_vel -2.0 30.0
Smooth_30_-2_1_UA678T_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 9.05207824304758 8.599389717089425 avg: 0.452688525
95815545  delta: 8.825733980068502
OFZLinear2-OFZLinear3 Avg: 6.740660506929681 6.493156957586269 avg: 0.24750354
934341257  delta: 6.616908732257976
OFZLinear4-OFZLinear5 Avg: 5.418965674916119 5.253898559644578 avg: 0.16506711
52715404  delta: 5.336432117280348
```



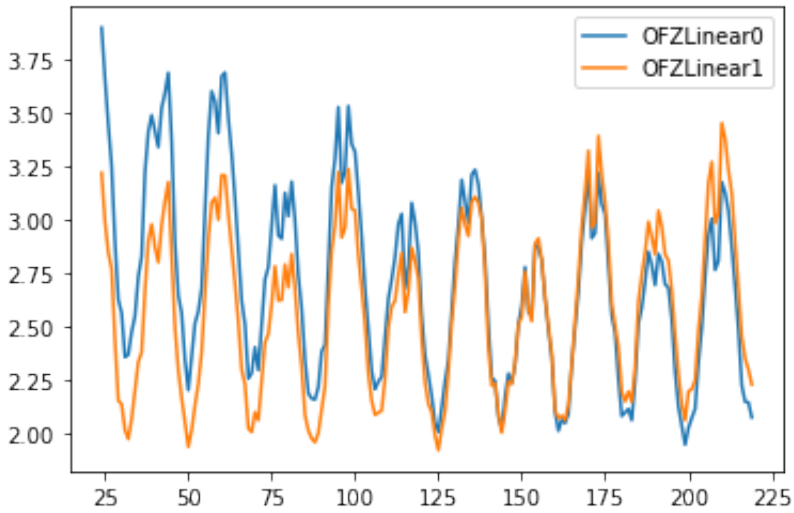

```
Smooth_30_-2_2_Z2CEPT_res2.p
Rot_vel -2.0 30.0
Smooth_30_-2_2_Z2CEPT_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 9.053808744426584 8.602216284117123 avg: 0.45159246
030946143  delta: 8.828012514271855
OFZLinear2-OFZLinear3 Avg: 6.741135782465821 6.493589964518271 avg: 0.24754581
794755026  delta: 6.617362873492046
OFZLinear4-OFZLinear5 Avg: 5.418283699944683 5.251871680953886 avg: 0.16641201
89907976  delta: 5.3350776904492845
```



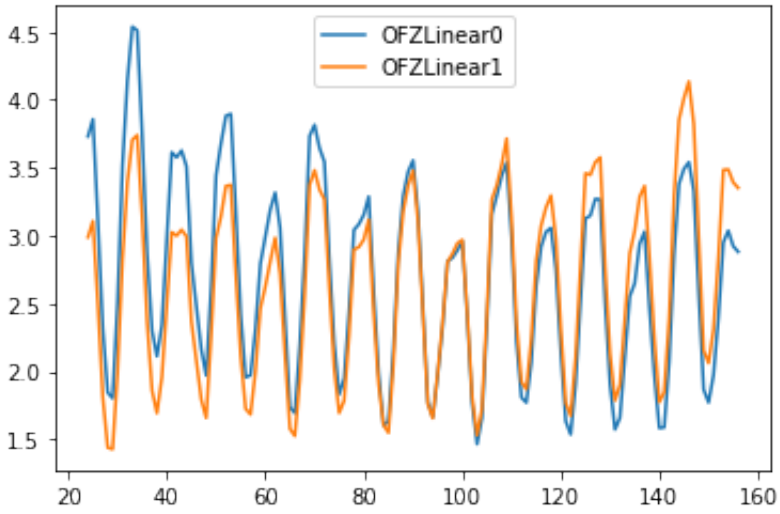

```
Smooth_30_-2_3_DPNF63_res2.p
Rot_vel -2.0 30.0
Smooth_30_-2_3_DPNF63_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 9.048348636151776 8.599980107157567 avg: 0.44836852
899420876  delta: 8.824164371654671
OFZLinear2-OFZLinear3 Avg: 6.738399492653933 6.49068696339476 avg: 0.247712529
2591733  delta: 6.614543228024346
OFZLinear4-OFZLinear5 Avg: 5.41619494171524 5.250018990624117 avg: 0.166175951
09112315  delta: 5.333106966169678
```



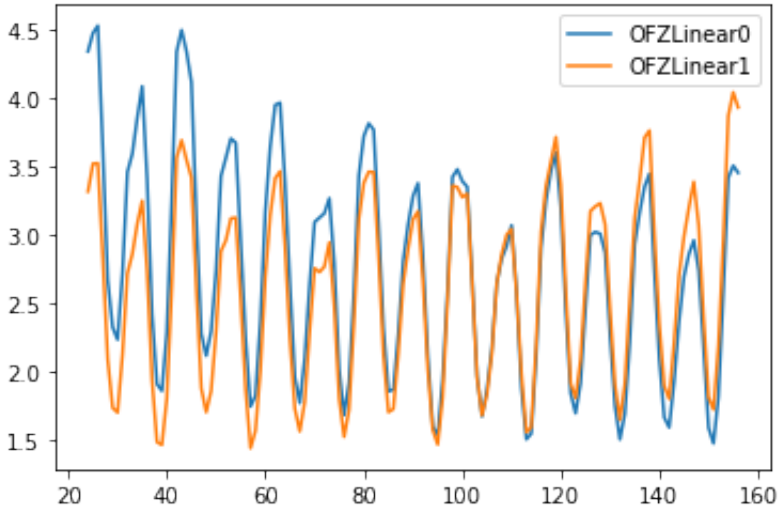

```
Smooth_30_-2_4_O2G6SZ_res2.p
Rot_vel -2.0 30.0
Smooth_30_-2_4_O2G6SZ_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 9.03185525375438 8.588082885997943 avg: 0.443772367
756436  delta: 8.80996906987616
OFZLinear2-OFZLinear3 Avg: 6.721593392550916 6.479782428016239 avg: 0.24181096
45346771  delta: 6.600687910283577
OFZLinear4-OFZLinear5 Avg: 5.402583186620962 5.24114161790953 avg: 0.161441568
71143256  delta: 5.321862402265246
```



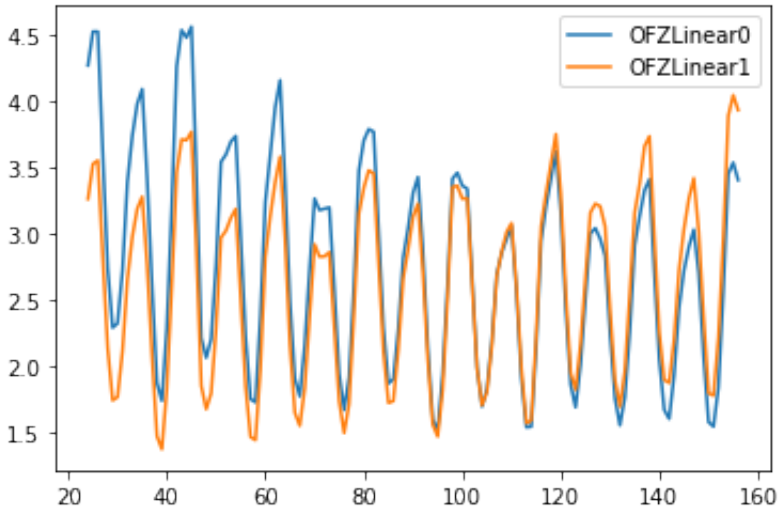

```
Smooth_30_-4_0_9WKFQF_res2.p
Rot_vel -4.0 30.0
Smooth_30_-4_0_9WKFQF_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 8.991919996686473 8.755992753343333 avg: 0.23592724
334313964  delta: 8.873956375014902
OFZLinear2-OFZLinear3 Avg: 6.738397588837413 6.623494343868607 avg: 0.11490324
496880522  delta: 6.6809459663530095
OFZLinear4-OFZLinear5 Avg: 5.408117349357041 5.333311223156622 avg: 0.07480612
620041871  delta: 5.370714286256831
```



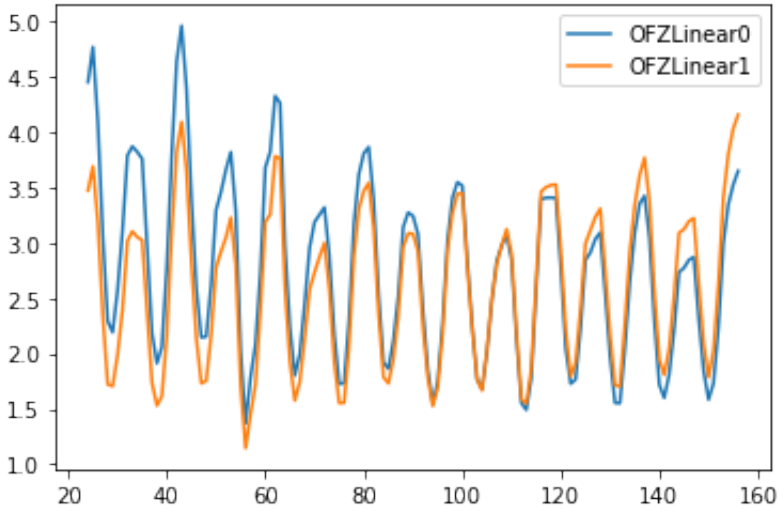

```
Smooth_30_-4_1_B6QVWT_res2.p
Rot_vel -4.0 30.0
Smooth_30_-4_1_B6QVWT_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.192885450521771 8.650615743460342 avg: 0.54226970
70614291  delta: 8.921750596991057
OFZLinear2-OFZLinear3 Avg: 6.840519539981256 6.542931608564652 avg: 0.29758793
141660345  delta: 6.6917255742729544
OFZLinear4-OFZLinear5 Avg: 5.498402879695436 5.303814749925716 avg: 0.19458812
976971984  delta: 5.401108814810576
```



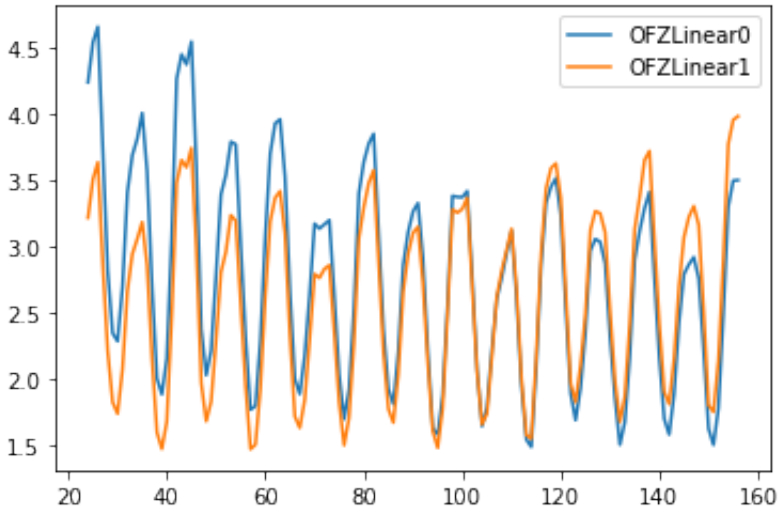

```
Smooth_30_-4_2_9YG7KZ_res2.p
Rot_vel -4.0 30.0
Smooth_30_-4_2_9YG7KZ_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.21882195281377 8.675805640508633 avg: 0.543016312
3051361  delta: 8.947313796661202
OFZLinear2-OFZLinear3 Avg: 6.865245752900777 6.56693594428141 avg: 0.298309808
61936673  delta: 6.716090848591094
OFZLinear4-OFZLinear5 Avg: 5.519425238199969 5.3260896471147 avg: 0.1933355910
85269  delta: 5.422757442657335
```



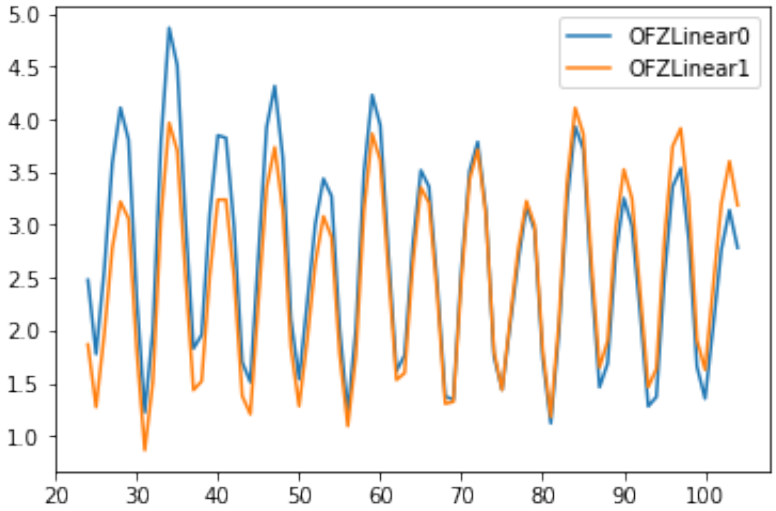

```
Smooth_30_-4_3_ZZ3YEH_res2.p
Rot_vel -4.0 30.0
Smooth_30_-4_3_ZZ3YEH_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.209900487411462 8.686647851673209 avg: 0.52325263
57382525  delta: 8.948274169542335
OFZLinear2-OFZLinear3 Avg: 6.859365444921196 6.572975447431719 avg: 0.28638999
748947747  delta: 6.7161704461764575
OFZLinear4-OFZLinear5 Avg: 5.520222774441332 5.336873969412221 avg: 0.18334880
502911055  delta: 5.428548371926777
```



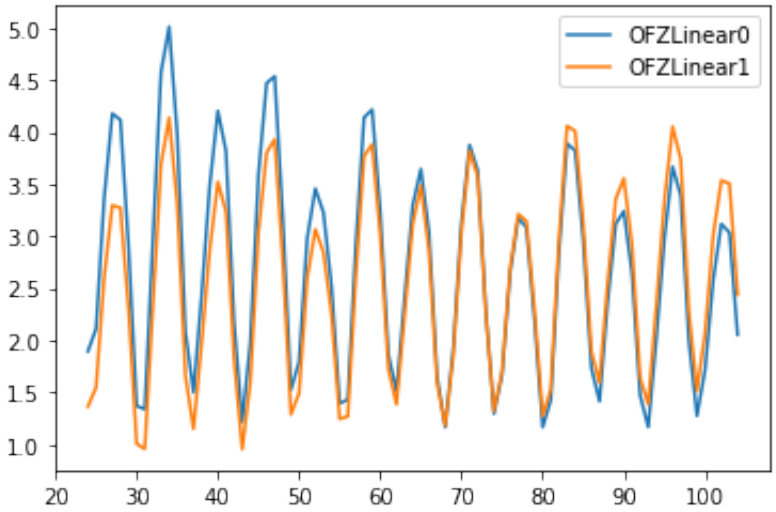

```
Smooth_30_-4_4_ARXESZ_res2.p
Rot_vel -4.0 30.0
Smooth_30_-4_4_ARXESZ_res3.p
(138, 27)
OFZLinear0-OFZLinear1 Avg: 9.221733088636816 8.67007389879473 avg: 0.551659189
842086  delta: 8.945903493715772
OFZLinear2-OFZLinear3 Avg: 6.861349329848965 6.558303262859269 avg: 0.30304606
69896957  delta: 6.709826296354117
OFZLinear4-OFZLinear5 Avg: 5.5166227291336005 5.320514228602442 avg: 0.1961085
0053115847  delta: 5.418568478868021
```



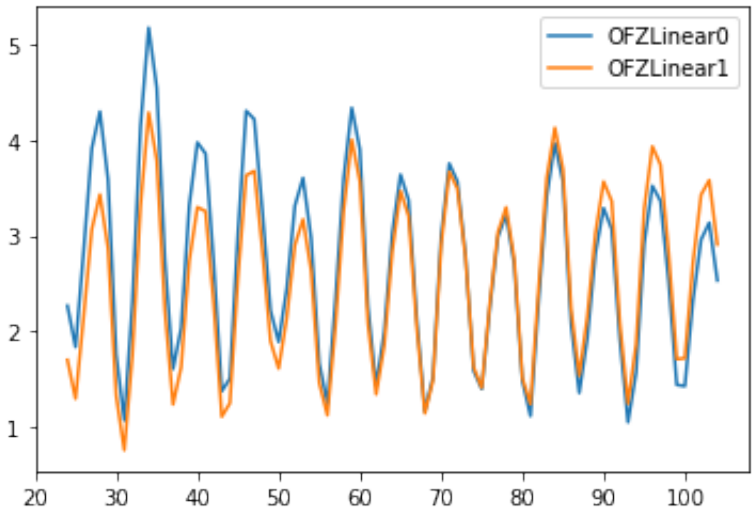

```
Smooth_30_-6_0_HOA2A3_res2.p
Rot_vel -6.0 30.0
Smooth_30_-6_0_HOA2A3_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 8.939401749511001 8.418499248529347 avg: 0.52090250
09816539  delta: 8.678950499020175
OFZLinear2-OFZLinear3 Avg: 6.640765412628277 6.34485400018422 avg: 0.295911412
44405694  delta: 6.492809706406248
OFZLinear4-OFZLinear5 Avg: 5.31655696354267 5.131114663150192 avg: 0.185442300
3924781  delta: 5.223835813346431
```



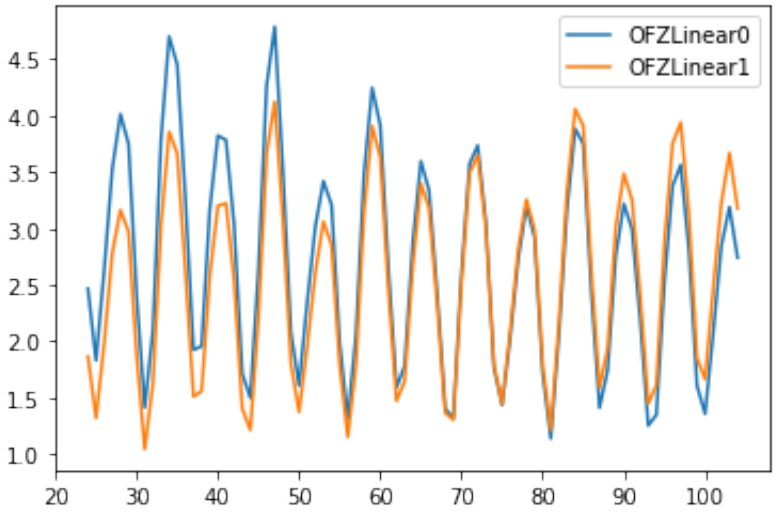

```
Smooth_30_-6_1_2F304V_res2.p
Rot_vel -6.0 30.0
Smooth_30_-6_1_2F304V_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 8.96572502517459 8.46104440948689 avg: 0.5046806156
877004  delta: 8.71338471733074
OFZLinear2-OFZLinear3 Avg: 6.661187359705814 6.386879553868202 avg: 0.27430780
583761205  delta: 6.524033456787008
OFZLinear4-OFZLinear5 Avg: 5.339304574760826 5.172672345955163 avg: 0.16663222
88056632  delta: 5.255988460357994
```



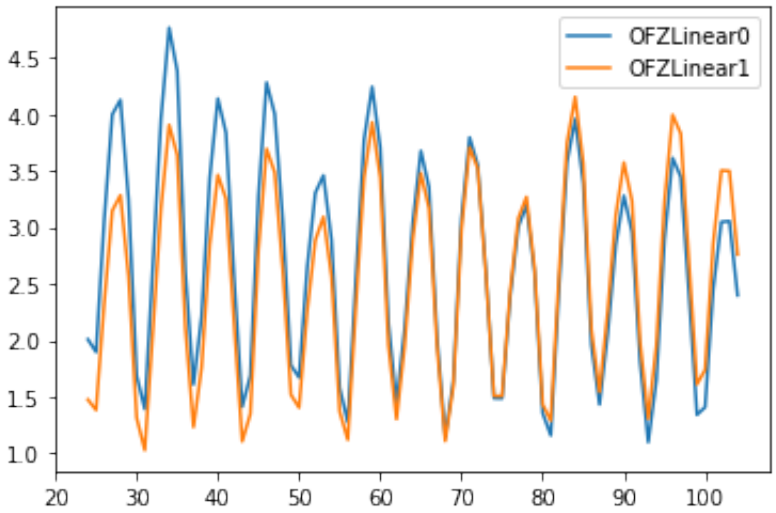

```
Smooth_30_-6_2_R5OVIS_res2.p
Rot_vel -6.0 30.0
Smooth_30_-6_2_R5OVIS_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 8.980308737151075 8.46316682459932 avg: 0.517141912
5517556  delta: 8.721737780875198
OFZLinear2-OFZLinear3 Avg: 6.676474536427802 6.392270851430423 avg: 0.28420368
499737947  delta: 6.534372693929113
OFZLinear4-OFZLinear5 Avg: 5.3562085482165225 5.176222151214664 avg: 0.1799863
9700185848  delta: 5.266215349715593
```



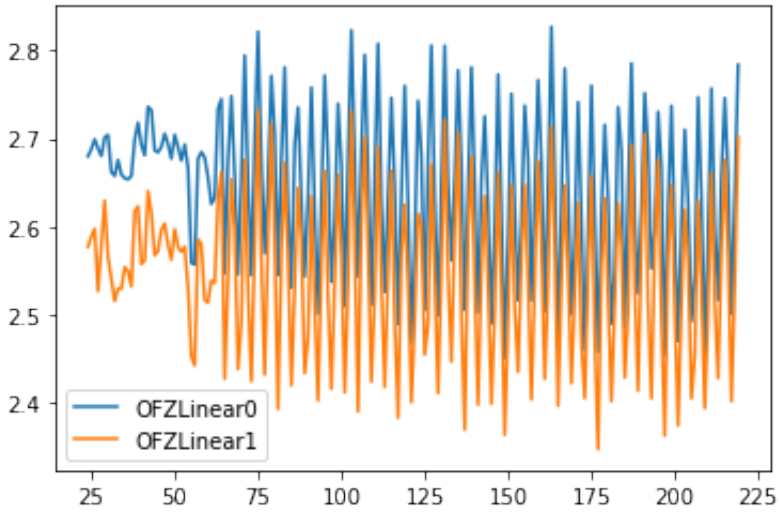

```
Smooth_30_-6_3_7A1JE7_res2.p
Rot_vel -6.0 30.0
Smooth_30_-6_3_7A1JE7_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 8.987651510977667 8.464581910701202 avg: 0.52306960
02764645  delta: 8.726116710839435
OFZLinear2-OFZLinear3 Avg: 6.683365907262498 6.392139816764201 avg: 0.29122609
049829684  delta: 6.53775286201335
OFZLinear4-OFZLinear5 Avg: 5.3622938543033465 5.1805615223235595 avg: 0.181732
331979787  delta: 5.271427688313453
```



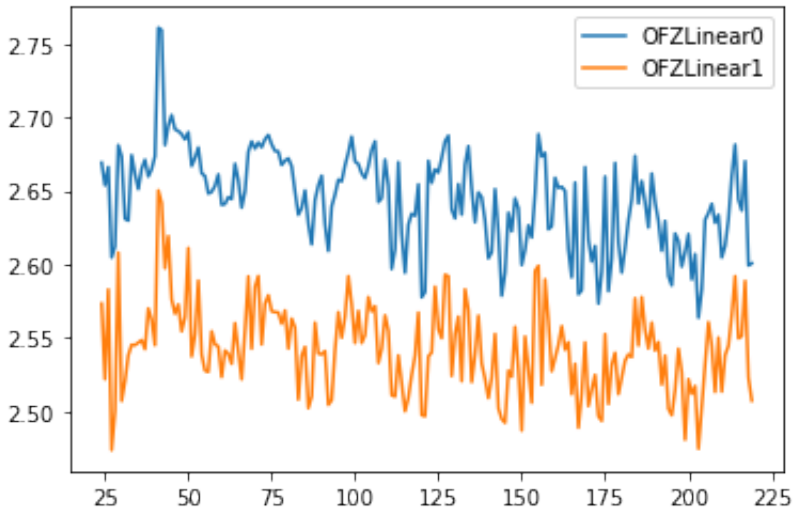

```
Smooth_30_-6_4_YKIR3Y_res2.p
Rot_vel -6.0 30.0
Smooth_30_-6_4_YKIR3Y_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 8.929333565105612 8.421480315387651 avg: 0.50785324
97179609  delta: 8.675406940246631
OFZLinear2-OFZLinear3 Avg: 6.624569981906096 6.347029056375034 avg: 0.27754092
55310626  delta: 6.485799519140565
OFZLinear4-OFZLinear5 Avg: 5.30291733596103 5.127128926207326 avg: 0.175788409
75370458  delta: 5.215023131084179
```



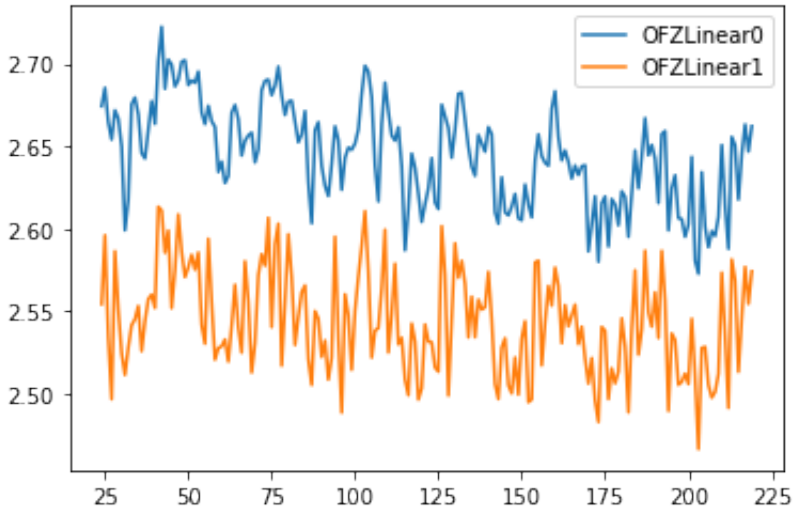

```
Smooth_30_0_0_TOWEUT_res2.p
Rot_vel 0.0 30.0
Smooth_30_0_0_TOWEUT_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.82066054814527 8.480067808611864 avg: 0.340592739
5334061  delta: 8.650364178378567
OFZLinear2-OFZLinear3 Avg: 6.571167551335834 6.400429985555661 avg: 0.17073756
578017285  delta: 6.485798768445747
OFZLinear4-OFZLinear5 Avg: 5.304084172865161 5.177249525274549 avg: 0.12683464
759061192  delta: 5.240666849069855
```



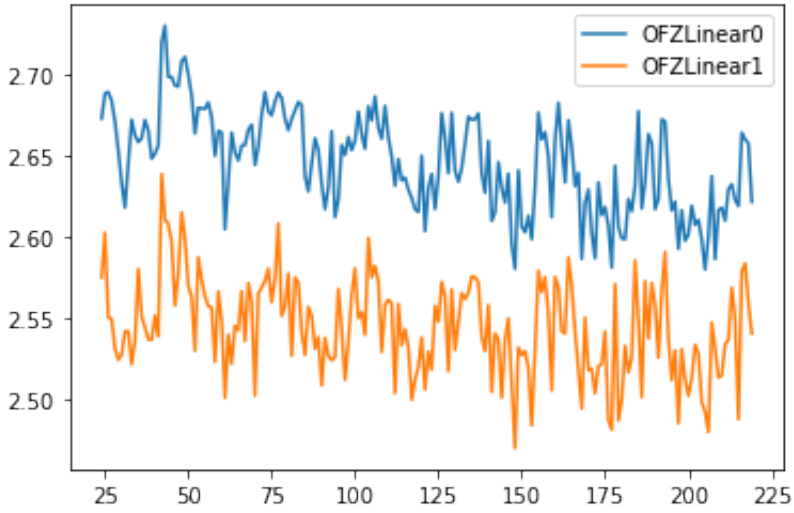

```
Smooth_30_0_1_RB5B21_res2.p
Rot_vel 0.0 30.0
Smooth_30_0_1_RB5B21_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.815406471693596 8.477150193688008 avg: 0.33825627
80055878  delta: 8.646278332690802
OFZLinear2-OFZLinear3 Avg: 6.560008681955792 6.387803447084363 avg: 0.17220523
48714289  delta: 6.473906064520078
OFZLinear4-OFZLinear5 Avg: 5.297769078997527 5.170889462338013 avg: 0.12687961
66595143  delta: 5.23432927066777
```



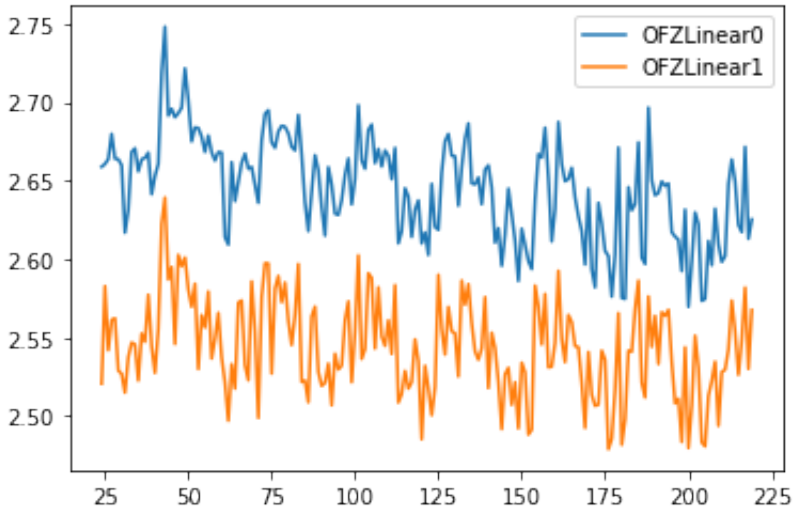

```
Smooth_30_0_2_AAU13M_res2.p
Rot_vel 0.0 30.0
Smooth_30_0_2_AAU13M_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.818092293479815 8.47802219747686 avg: 0.340070096
0029539  delta: 8.648057245478338
OFZLinear2-OFZLinear3 Avg: 6.561706858832821 6.389718301036732 avg: 0.17198855
779608913  delta: 6.475712579934776
OFZLinear4-OFZLinear5 Avg: 5.300951158108354 5.173465704836812 avg: 0.12748545
327154215  delta: 5.237208431472583
```



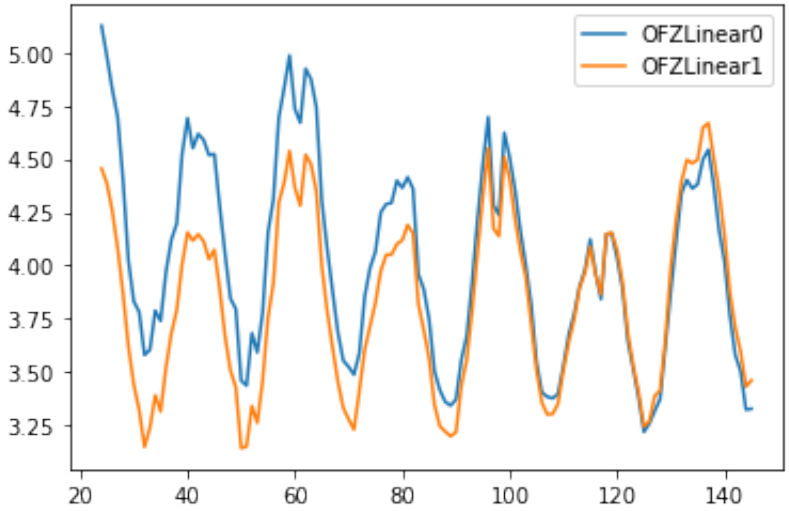

```
Smooth_30_0_3_STATJY_res2.p
Rot_vel 0.0 30.0
Smooth_30_0_3_STATJY_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.819927865145157 8.479803439711226 avg: 0.34012442
543393107  delta: 8.649865652428192
OFZLinear2-OFZLinear3 Avg: 6.561929980913798 6.389916087088941 avg: 0.17201389
382485743  delta: 6.47592303400137
OFZLinear4-OFZLinear5 Avg: 5.299907825431045 5.172153125409366 avg: 0.12775470
00216792  delta: 5.236030475420206
```



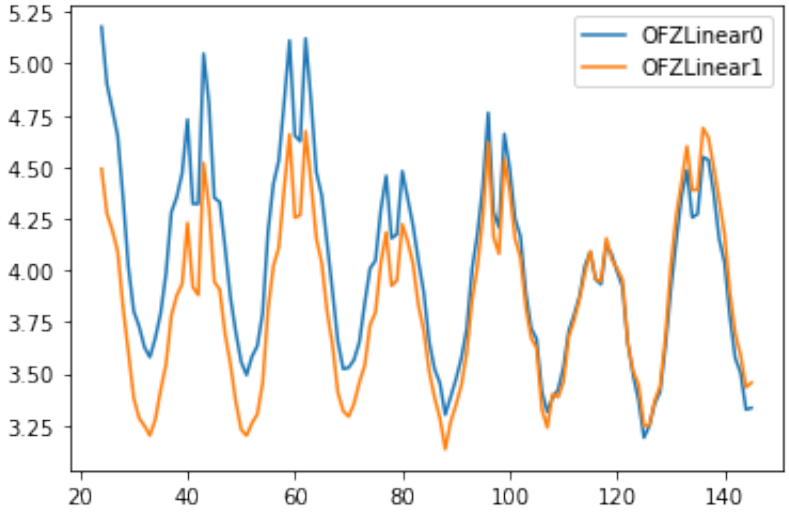

```
Smooth_30_0_4_YKCRBC_res2.p
Rot_vel 0.0 30.0
Smooth_30_0_4_YKCRBC_res3.p
(201, 27)
OFZLinear0-OFZLinear1 Avg: 8.818895208592318 8.479279048588811 avg: 0.33961616
00035068  delta: 8.649087128590565
OFZLinear2-OFZLinear3 Avg: 6.562054775604585 6.390239071278344 avg: 0.17181570
43262405  delta: 6.476146923441465
OFZLinear4-OFZLinear5 Avg: 5.299893968364819 5.172589074592201 avg: 0.12730489
377261822  delta: 5.23624152147851
```



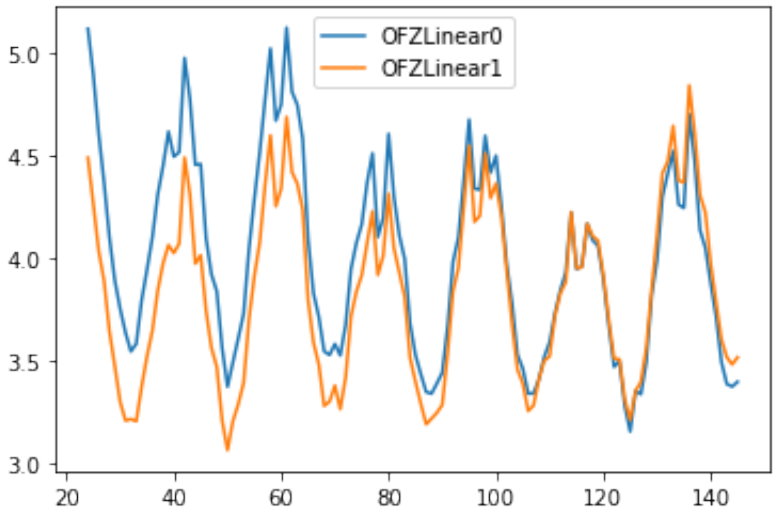

```
Smooth_45_-2_0_3P4T66_res2.p
Rot_vel -2.0 45.0
Smooth_45_-2_0_3P4T66_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.944212187678097 8.520395596808514 avg: 0.42381659
0869583  delta: 8.732303892243305
OFZLinear2-OFZLinear3 Avg: 6.656166895613865 6.435251151226128 avg: 0.22091574
438773698  delta: 6.545709023419996
OFZLinear4-OFZLinear5 Avg: 5.355968921801027 5.1981683263590766 avg: 0.1578005
954419508  delta: 5.2770686240800515
```



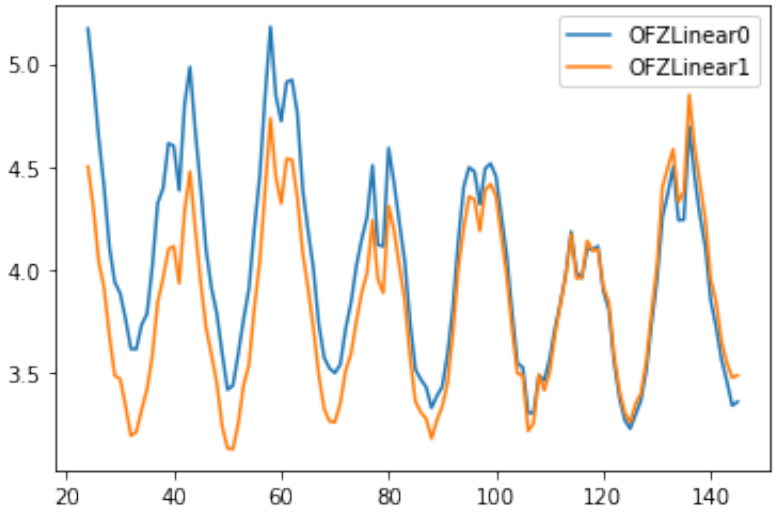

```
Smooth_45_-2_1_JFT8WZ_res2.p
Rot_vel -2.0 45.0
Smooth_45_-2_1_JFT8WZ_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.944593317423658 8.522361397941314 avg: 0.42223191
94823445  delta: 8.733477357682485
OFZLinear2-OFZLinear3 Avg: 6.655246878977707 6.43499525133647 avg: 0.220251627
64123696  delta: 6.545121065157089
OFZLinear4-OFZLinear5 Avg: 5.355163330242744 5.199767271207353 avg: 0.15539605
903539133  delta: 5.277465300725049
```



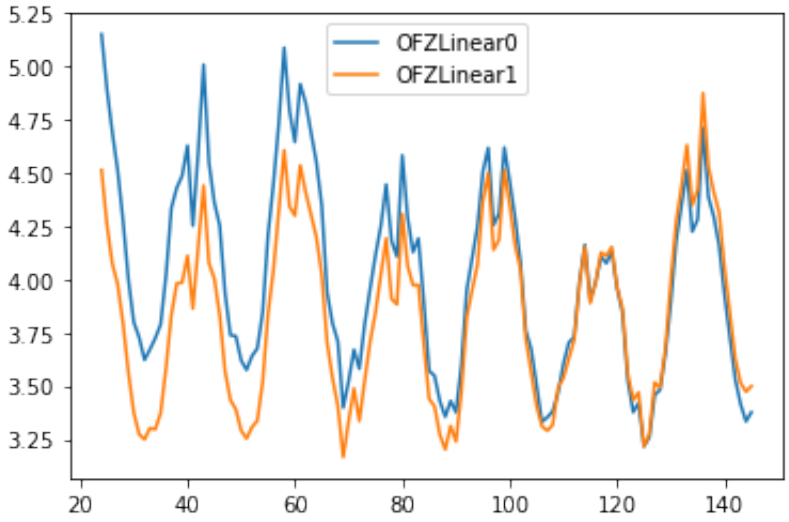

```
Smooth_45_-2_2_XM1ETY_res2.p
Rot_vel -2.0 45.0
Smooth_45_-2_2_XM1ETY_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.924922161209468 8.513252067655817 avg: 0.41167009
355365103  delta: 8.719087114432643
OFZLinear2-OFZLinear3 Avg: 6.640824902950642 6.42659201817863 avg: 0.214232884
77201208  delta: 6.533708460564636
OFZLinear4-OFZLinear5 Avg: 5.340628536691501 5.188764101525782 avg: 0.15186443
516571835  delta: 5.2646963191086416
```



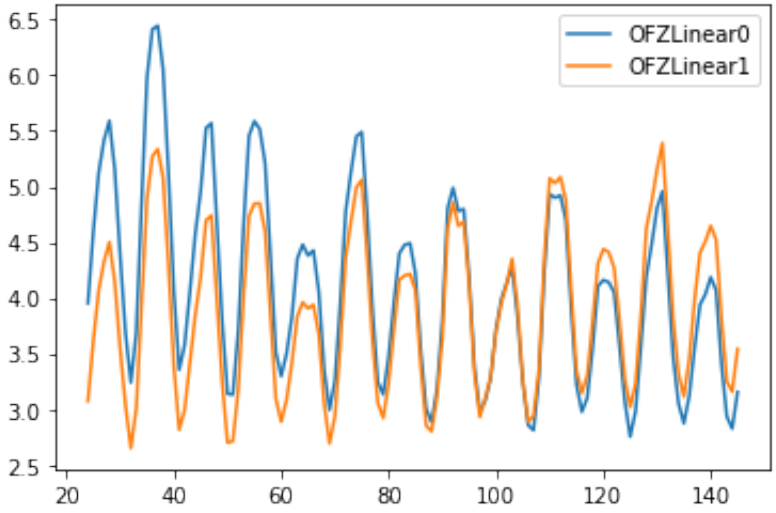

```
Smooth_45_-2_3_BR9Z93_res2.p
Rot_vel -2.0 45.0
Smooth_45_-2_3_BR9Z93_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.931948604129511 8.516888022238925 avg: 0.41506058
18905859  delta: 8.724418313184218
OFZLinear2-OFZLinear3 Avg: 6.646232922002312 6.429312350159397 avg: 0.21692057
184291524  delta: 6.537772636080854
OFZLinear4-OFZLinear5 Avg: 5.346330860170312 5.193756151512612 avg: 0.15257470
865770006  delta: 5.270043505841462
```



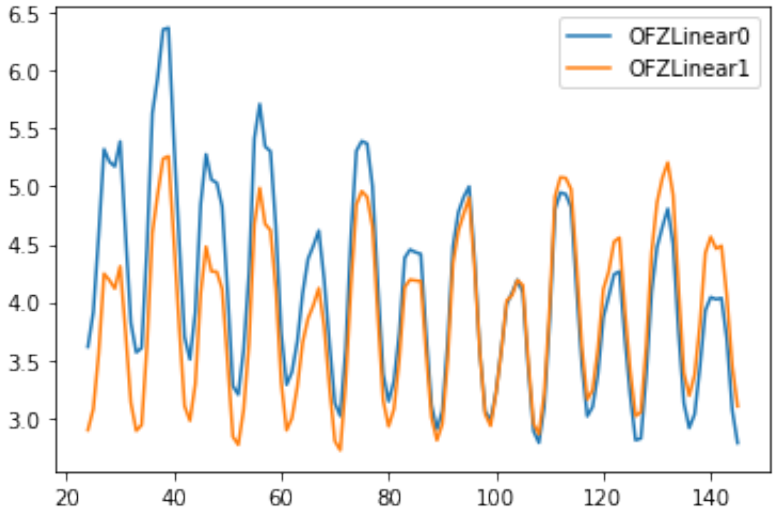

```
Smooth_45_-2_4_OZMRTY_res2.p
Rot_vel -2.0 45.0
Smooth_45_-2_4_OZMRTY_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.936063150916938 8.518642235523112 avg: 0.41742091
53938264  delta: 8.727352693220025
OFZLinear2-OFZLinear3 Avg: 6.649774955039144 6.432005783349502 avg: 0.21776917
168964172  delta: 6.540890369194322
OFZLinear4-OFZLinear5 Avg: 5.346146680881516 5.192142926132112 avg: 0.15400375
474940375  delta: 5.269144803506814
```



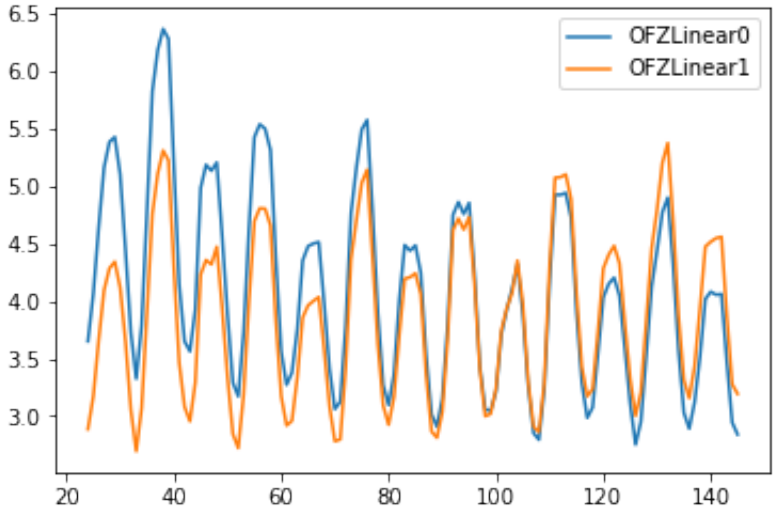

```
Smooth_45_-4_0_GNGX25_res2.p
Rot_vel -4.0 45.0
Smooth_45_-4_0_GNGX25_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 9.105271012032308 8.616460123658204 avg: 0.48881088
8374104  delta: 8.860865567845256
OFZLinear2-OFZLinear3 Avg: 6.750044986570544 6.486916556446917 avg: 0.26312843
01236274  delta: 6.618480771508731
OFZLinear4-OFZLinear5 Avg: 5.4072747942302835 5.2340634553338825 avg: 0.173211
33889640095  delta: 5.320669124782083
```



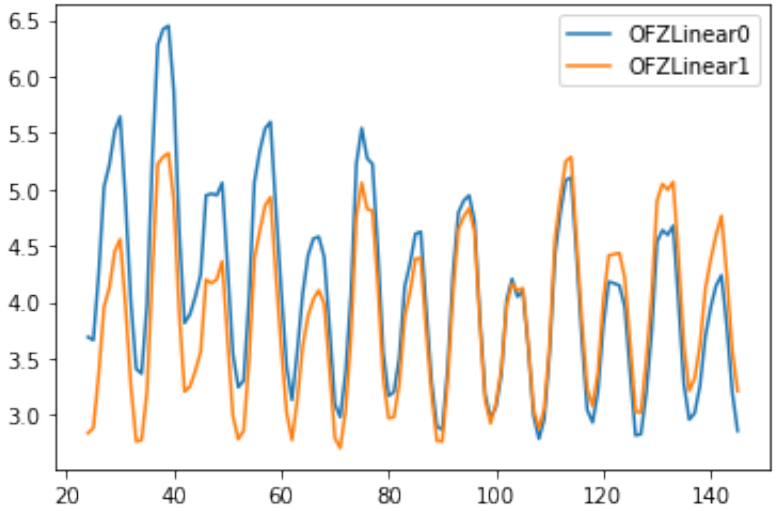

```
Smooth_45_-4_1_DPV5FD_res2.p
Rot_vel -4.0 45.0
Smooth_45_-4_1_DPV5FD_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 9.120736292724798 8.605497627254042 avg: 0.51523866
54707559  delta: 8.86311695998942
OFZLinear2-OFZLinear3 Avg: 6.7557410876565775 6.477601534751956 avg: 0.2781395
529046211  delta: 6.616671311204267
OFZLinear4-OFZLinear5 Avg: 5.414276087932029 5.23440077048802 avg: 0.179875317
44400886  delta: 5.324338429210025
```



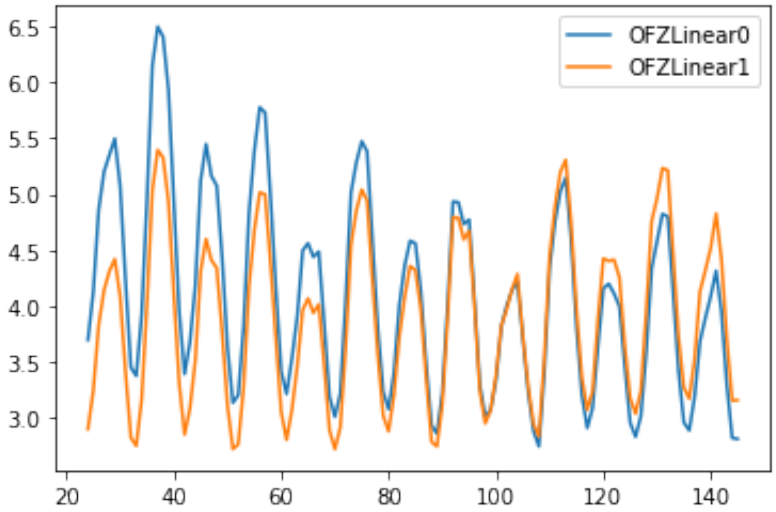

```
Smooth_45_-4_2_BZ37KH_res2.p
Rot_vel -4.0 45.0
Smooth_45_-4_2_BZ37KH_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 9.11897677607077 8.608106764676858 avg: 0.510870011
3939122  delta: 8.863541770373814
OFZLinear2-OFZLinear3 Avg: 6.757121042060196 6.480536194579864 avg: 0.27658484
748033185  delta: 6.61882861832003
OFZLinear4-OFZLinear5 Avg: 5.412709065231307 5.231519591066282 avg: 0.18118947
41650253  delta: 5.322114328148794
```



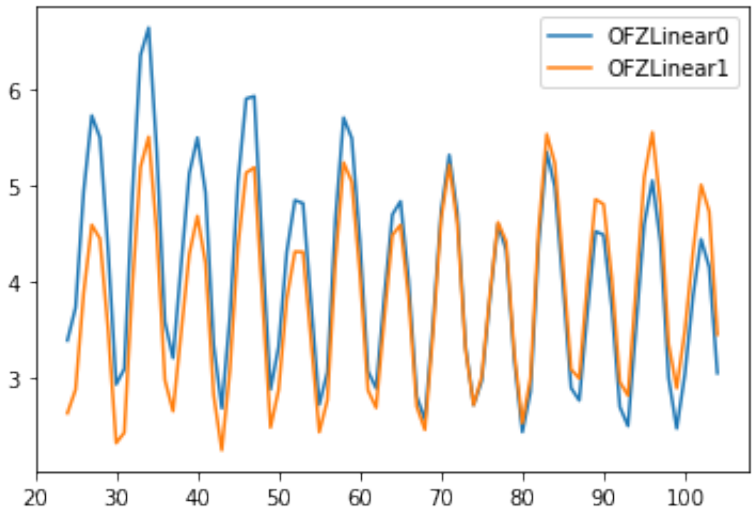

```
Smooth_45_-4_3_GRNIXW_res2.p
Rot_vel -4.0 45.0
Smooth_45_-4_3_GRNIXW_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 9.128913233710605 8.604495055413226 avg: 0.52441817
82973794  delta: 8.866704144561915
OFZLinear2-OFZLinear3 Avg: 6.765741325528468 6.48193555832728 avg: 0.283805767
201188  delta: 6.623838441927875
OFZLinear4-OFZLinear5 Avg: 5.4204274877532885 5.237884175115298 avg: 0.1825433
1263799095  delta: 5.329155831434293
```



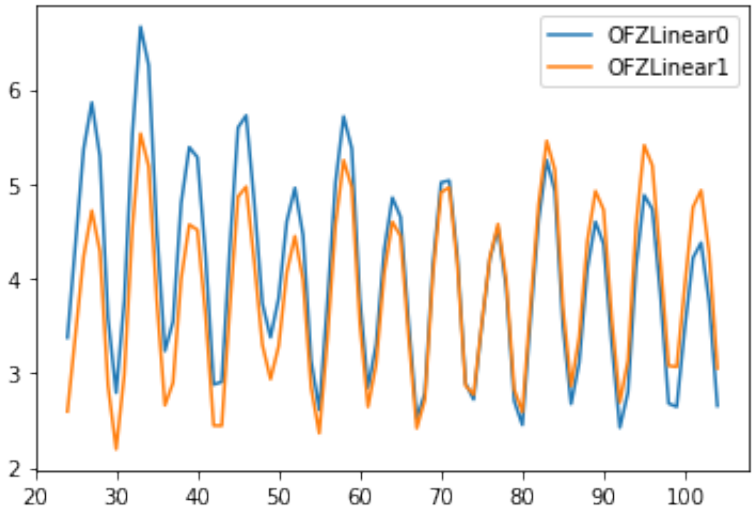

```
Smooth_45_-4_4_810HRV_res2.p
Rot_vel -4.0 45.0
Smooth_45_-4_4_810HRV_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 9.115292741239276 8.608370525788775 avg: 0.50692221
54505013  delta: 8.861831633514026
OFZLinear2-OFZLinear3 Avg: 6.754108030682287 6.477705416129886 avg: 0.27640261
4552401  delta: 6.615906723406087
OFZLinear4-OFZLinear5 Avg: 5.412488576949266 5.23308688797263 avg: 0.179401688
9766361  delta: 5.322787732460948
```



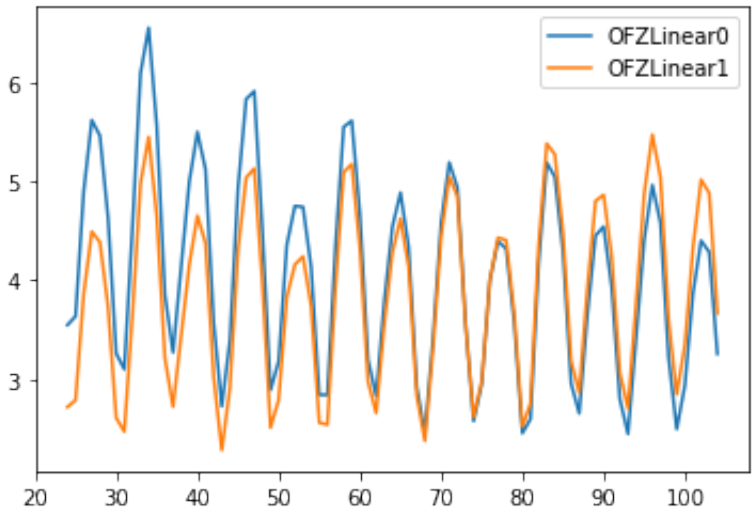

```
Smooth_45_-6_0_R378Z4_res2.p
Rot_vel -6.0 45.0
Smooth_45_-6_0_R378Z4_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.039273553083058 8.549386258364128 avg: 0.48988729
471892967  delta: 8.794329905723593
OFZLinear2-OFZLinear3 Avg: 6.7216037420023484 6.451037682672572 avg: 0.2705660
593297763  delta: 6.586320712337461
OFZLinear4-OFZLinear5 Avg: 5.387475125594881 5.219241041592136 avg: 0.16823408
40027452  delta: 5.303358083593508
```



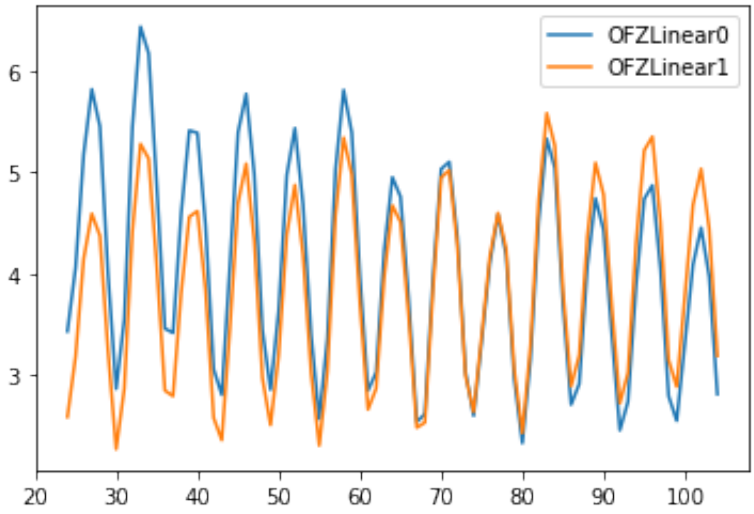

```
Smooth_45_-6_1_0NECPK_res2.p
Rot_vel -6.0 45.0
Smooth_45_-6_1_0NECPK_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.032372643090323 8.55418828100133 avg: 0.478184362
0889923  delta: 8.793280462045827
OFZLinear2-OFZLinear3 Avg: 6.709217509025126 6.445352097613171 avg: 0.26386541
14119552  delta: 6.577284803319149
OFZLinear4-OFZLinear5 Avg: 5.376443993441879 5.2104305700566105 avg: 0.1660134
233852686  delta: 5.293437281749245
```



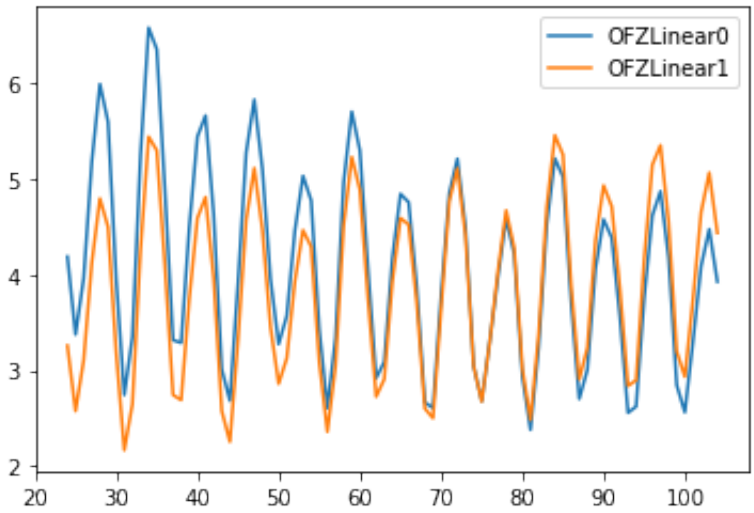

```
Smooth_45_-6_2_U2KIG0_res2.p
Rot_vel -6.0 45.0
Smooth_45_-6_2_U2KIG0_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.054310902662863 8.556868159567086 avg: 0.49744274
30957764  delta: 8.805589531114975
OFZLinear2-OFZLinear3 Avg: 6.731860986877486 6.457530294541265 avg: 0.27433069
23362203  delta: 6.594695640709375
OFZLinear4-OFZLinear5 Avg: 5.3972124965110195 5.2237998190172155 avg: 0.173412
67749380407  delta: 5.3105061577641175
```



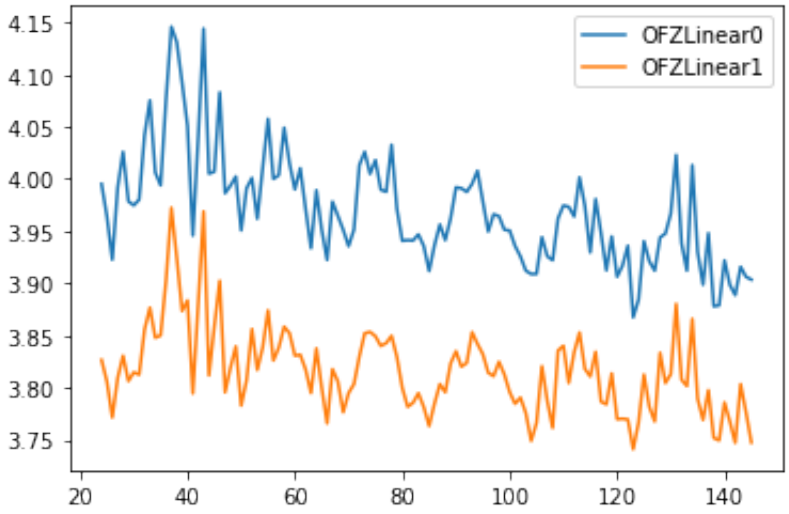

```
Smooth_45_-6_3_9UF74H_res2.p
Rot_vel -6.0 45.0
Smooth_45_-6_3_9UF74H_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.041208831675634 8.557710666819657 avg: 0.48349816
485597685  delta: 8.799459749247646
OFZLinear2-OFZLinear3 Avg: 6.720780575257791 6.4524888994310245 avg: 0.2682916
758267666  delta: 6.586634737344408
OFZLinear4-OFZLinear5 Avg: 5.3901246085058405 5.2210718326310275 avg: 0.169052
77587481304  delta: 5.305598220568434
```



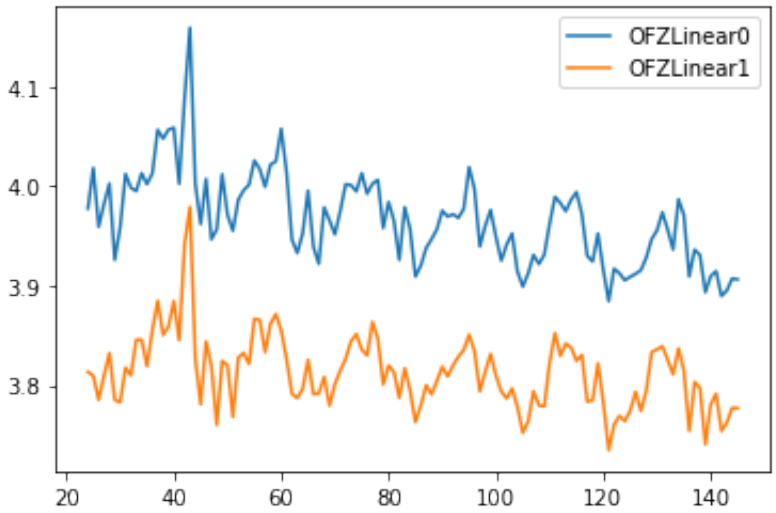

```
Smooth_45_-6_4_WAKIAQ_res2.p
Rot_vel -6.0 45.0
Smooth_45_-6_4_WAKIAQ_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.075978427915743 8.557122467285751 avg: 0.51885596
06299918  delta: 8.816550447600747
OFZLinear2-OFZLinear3 Avg: 6.754798811544059 6.460910296142469 avg: 0.29388851
54015898  delta: 6.607854553843264
OFZLinear4-OFZLinear5 Avg: 5.419077221393982 5.235334074915995 avg: 0.18374314
647798684  delta: 5.3272056481549885
```



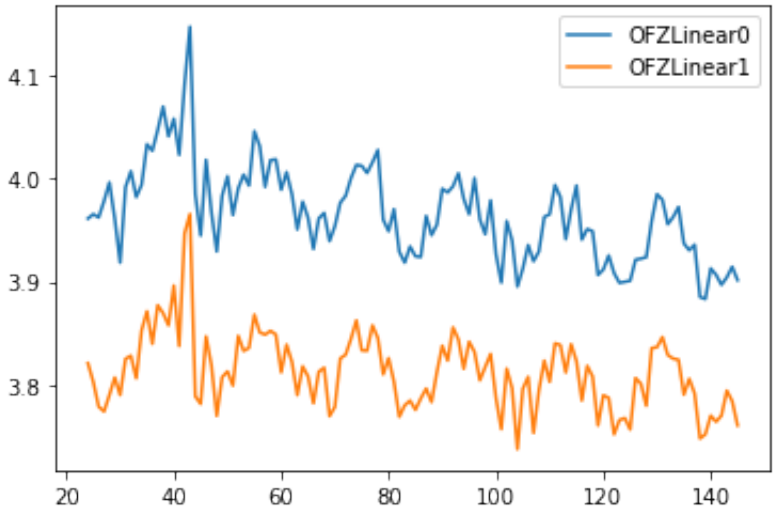

```
Smooth_45_0_0_V4SN9S_res2.p
Rot_vel 0.0 45.0
Smooth_45_0_0_V4SN9S_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.823053141977836 8.48092210748808 avg: 0.342131034
48975524  delta: 8.651987624732957
OFZLinear2-OFZLinear3 Avg: 6.573854343921543 6.403808732718935 avg: 0.17004561
120260764  delta: 6.488831538320239
OFZLinear4-OFZLinear5 Avg: 5.290874861628632 5.167241183352166 avg: 0.12363367
827646599  delta: 5.229058022490399
```



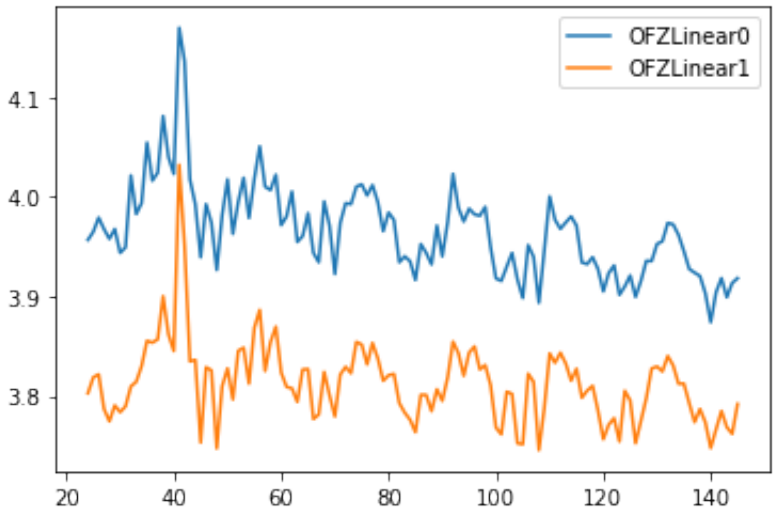

```
Smooth_45_0_1_IGTHOY_res2.p
Rot_vel 0.0 45.0
Smooth_45_0_1_IGTHOY_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.81615245277113 8.474027854280177 avg: 0.342124598
4909529  delta: 8.645090153525654
OFZLinear2-OFZLinear3 Avg: 6.564339418880276 6.394882849222541 avg: 0.16945656
96577346  delta: 6.479611134051408
OFZLinear4-OFZLinear5 Avg: 5.280358239818358 5.158026205385969 avg: 0.12233203
44323886  delta: 5.219192222602164
```



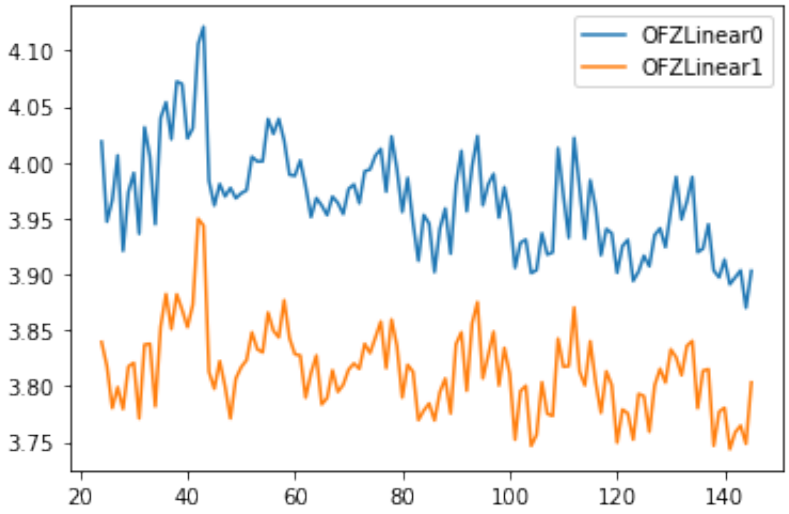

```
Smooth_45_0_2_B8A482_res2.p
Rot_vel 0.0 45.0
Smooth_45_0_2_B8A482_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.813852343185786 8.473340609468833 avg: 0.34051173
37169532  delta: 8.64359647632731
OFZLinear2-OFZLinear3 Avg: 6.563374978814187 6.393936826883118 avg: 0.16943815
193106904  delta: 6.478655902848653
OFZLinear4-OFZLinear5 Avg: 5.279433358128171 5.157634147963671 avg: 0.12179921
016449935  delta: 5.2185337530459215
```



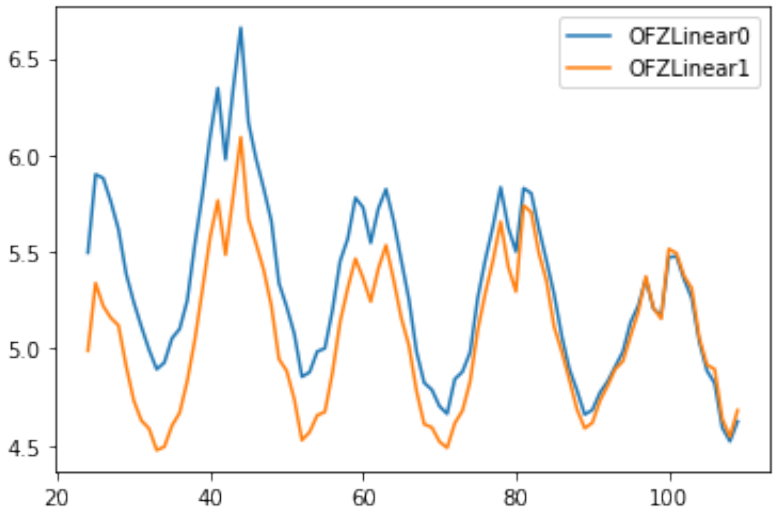

```
Smooth_45_0_3_9GBKOP_res2.p
Rot_vel 0.0 45.0
Smooth_45_0_3_9GBKOP_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.813928159425386 8.47330043876106 avg: 0.340627720
664326  delta: 8.643614299093223
OFZLinear2-OFZLinear3 Avg: 6.563357742323467 6.394368520851344 avg: 0.16898922
147212225  delta: 6.4788631315874055
OFZLinear4-OFZLinear5 Avg: 5.27952578549828 5.156685437443912 avg: 0.122840348
0543685  delta: 5.2181056114710955
```



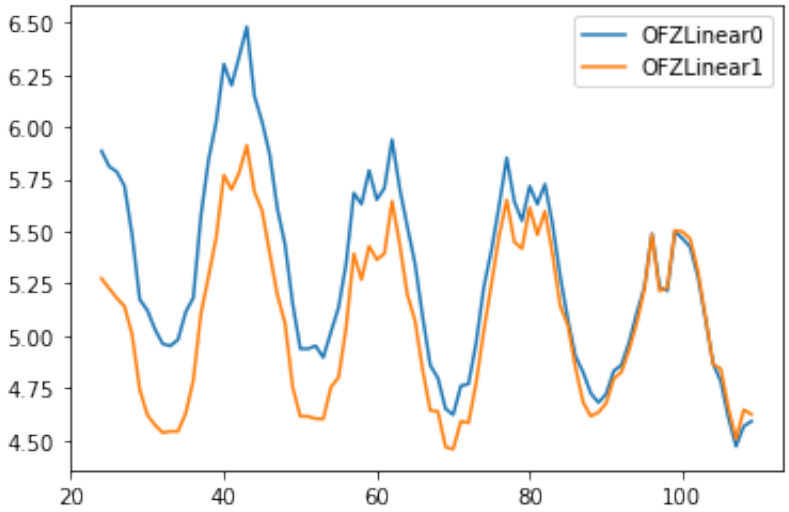

```
Smooth_45_0_4_SLPA8L_res2.p
Rot_vel 0.0 45.0
Smooth_45_0_4_SLPA8L_res3.p
(127, 27)
OFZLinear0-OFZLinear1 Avg: 8.814114838132875 8.473718036067943 avg: 0.34039680
206493195  delta: 8.643916437100408
OFZLinear2-OFZLinear3 Avg: 6.5638990176397165 6.395063170101256 avg: 0.1688358
4753846037  delta: 6.479481093870486
OFZLinear4-OFZLinear5 Avg: 5.280121992628866 5.157872319004357 avg: 0.12224967
362450823  delta: 5.218997155816611
```



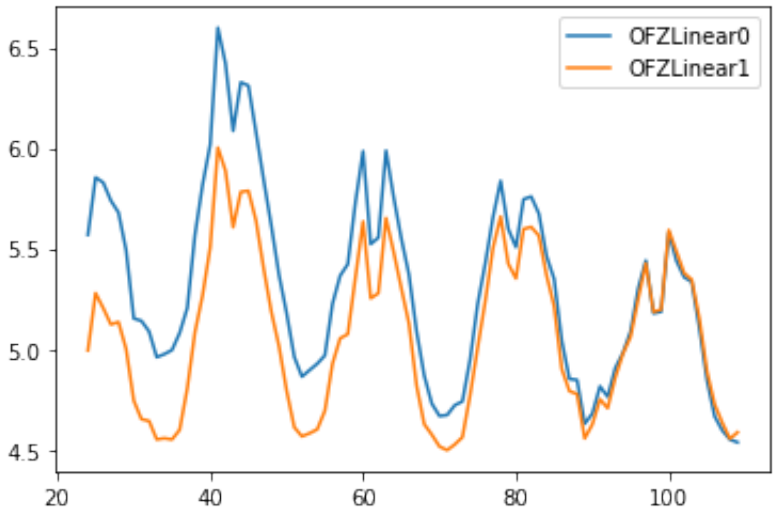

```
Smooth_60_-2_0_EENTSE_res2.p
Rot_vel -2.0 60.0
Smooth_60_-2_0_EENTSE_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.86206141780379 8.44540539348595 avg: 0.4166560243
178399  delta: 8.653733405644871
OFZLinear2-OFZLinear3 Avg: 6.574018517078281 6.364148606972389 avg: 0.20986991
01058923  delta: 6.469083562025335
OFZLinear4-OFZLinear5 Avg: 5.2786436871269515 5.126220692837434 avg: 0.1524229
942895179  delta: 5.202432189982193
```



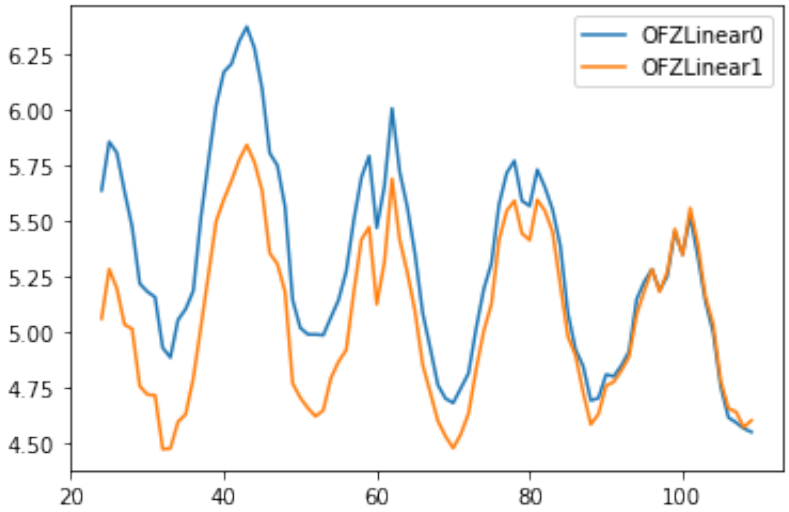

```
Smooth_60_-2_1_TOLJ0V_res2.p
Rot_vel -2.0 60.0
Smooth_60_-2_1_TOLJ0V_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.84930061373512 8.43989909018398 avg: 0.4094015235
5113923  delta: 8.64459985195955
OFZLinear2-OFZLinear3 Avg: 6.562461660283344 6.3597272910324 avg: 0.2027343692
50944  delta: 6.461094475657872
OFZLinear4-OFZLinear5 Avg: 5.2709373378167905 5.121328009824518 avg: 0.1496093
2799227233  delta: 5.196132673820655
```



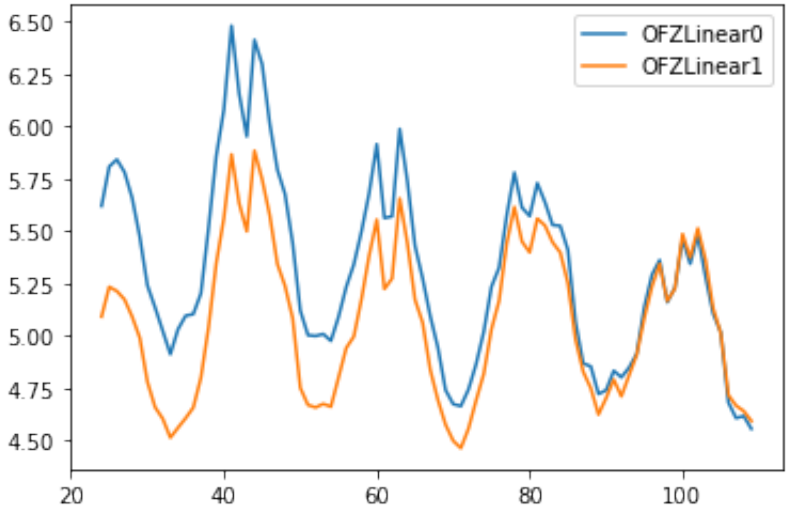

```
Smooth_60_-2_2_QJP3WV_res2.p
Rot_vel -2.0 60.0
Smooth_60_-2_2_QJP3WV_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.86674612655231 8.447590773425587 avg: 0.419155353
12672425  delta: 8.657168449988948
OFZLinear2-OFZLinear3 Avg: 6.575646692038782 6.366736460632646 avg: 0.20891023
140613552  delta: 6.471191576335714
OFZLinear4-OFZLinear5 Avg: 5.284738727893992 5.130950586040309 avg: 0.15378814
185368306  delta: 5.207844656967151
```



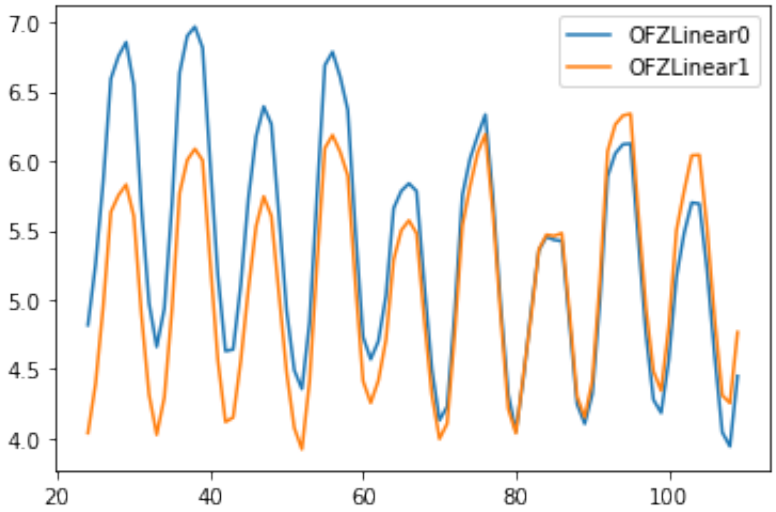

```
Smooth_60_-2_3_C9X5WP_res2.p
Rot_vel -2.0 60.0
Smooth_60_-2_3_C9X5WP_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.851687072657711 8.440881427237729 avg: 0.41080564
54199822  delta: 8.646284249947719
OFZLinear2-OFZLinear3 Avg: 6.564015592133465 6.359747980775459 avg: 0.20426761
135800664  delta: 6.461881786454462
OFZLinear4-OFZLinear5 Avg: 5.272968645581912 5.122367324117436 avg: 0.15060132
146447636  delta: 5.197667984849674
```



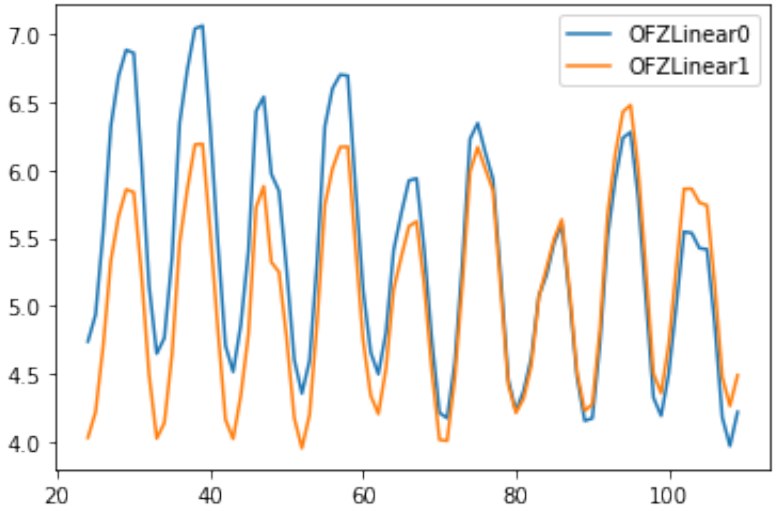

```
Smooth_60_-2_4_UX8ITL_res2.p
Rot_vel -2.0 60.0
Smooth_60_-2_4_UX8ITL_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.871104121537694 8.450370325645592 avg: 0.42073379
58921027  delta: 8.660737223591642
OFZLinear2-OFZLinear3 Avg: 6.579017761078052 6.368102519203835 avg: 0.21091524
187421662  delta: 6.473560140140943
OFZLinear4-OFZLinear5 Avg: 5.286729960407455 5.13201051988743 avg: 0.154719440
52002495  delta: 5.209370240147443
```



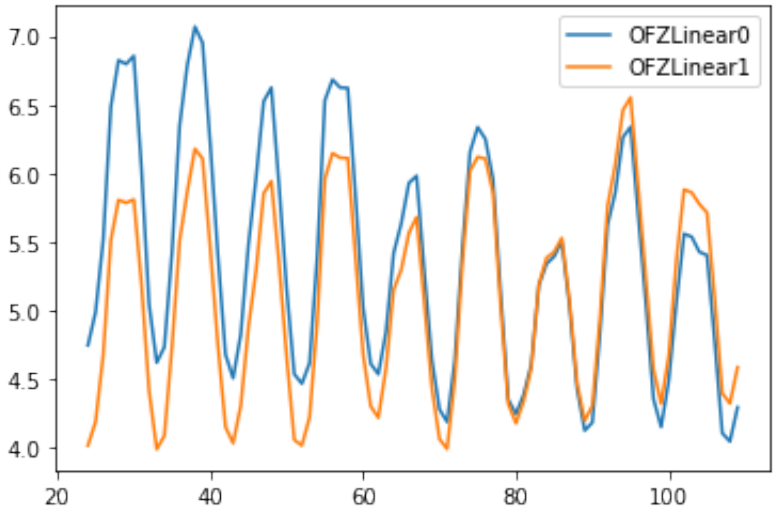

```
Smooth_60_-4_0_EVQ115_res2.p
Rot_vel -4.0 60.0
Smooth_60_-4_0_EVQ115_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.94531342080356 8.490198689917516 avg: 0.455114730
88604326  delta: 8.717756055360539
OFZLinear2-OFZLinear3 Avg: 6.632107673461301 6.382760539895488 avg: 0.24934713
356581373  delta: 6.507434106678394
OFZLinear4-OFZLinear5 Avg: 5.309390658055473 5.141559550375029 avg: 0.16783110
768044374  delta: 5.225475104215251
```



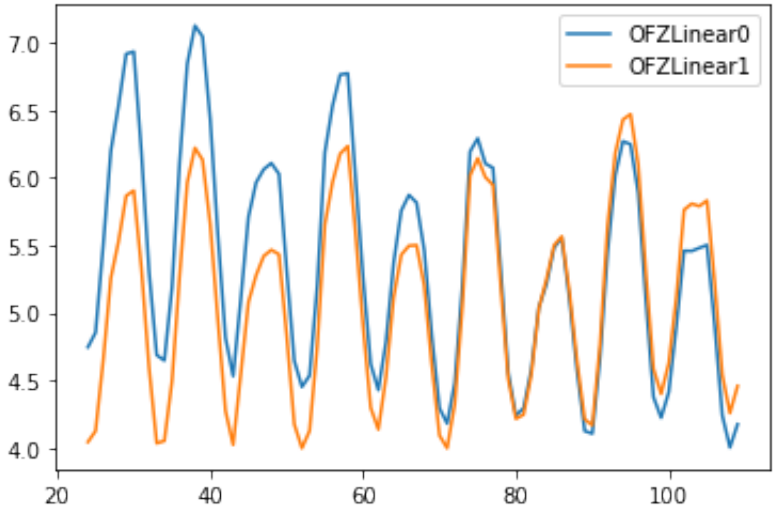

```
Smooth_60_-4_1_9CNJ4F_res2.p
Rot_vel -4.0 60.0
Smooth_60_-4_1_9CNJ4F_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.945471656519135 8.482170598558985 avg: 0.46330105
796015  delta: 8.71382112753906
OFZLinear2-OFZLinear3 Avg: 6.626113051982259 6.371241287763449 avg: 0.25487176
421880964  delta: 6.498677169872854
OFZLinear4-OFZLinear5 Avg: 5.307198927250322 5.134107423546806 avg: 0.17309150
370351656  delta: 5.220653175398564
```



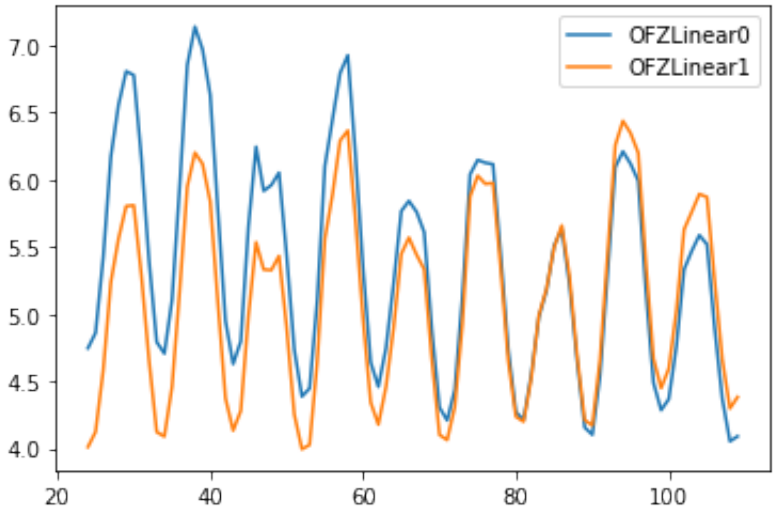

```
Smooth_60_-4_2_XJTK3X_res2.p
Rot_vel -4.0 60.0
Smooth_60_-4_2_XJTK3X_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.94591551395882 8.483042720989099 avg: 0.462872792
96972095  delta: 8.71447911747396
OFZLinear2-OFZLinear3 Avg: 6.62659626592874 6.373782533342951 avg: 0.252813732
5857882  delta: 6.500189399635845
OFZLinear4-OFZLinear5 Avg: 5.306612001454565 5.134106064657348 avg: 0.17250593
679721682  delta: 5.220359033055956
```



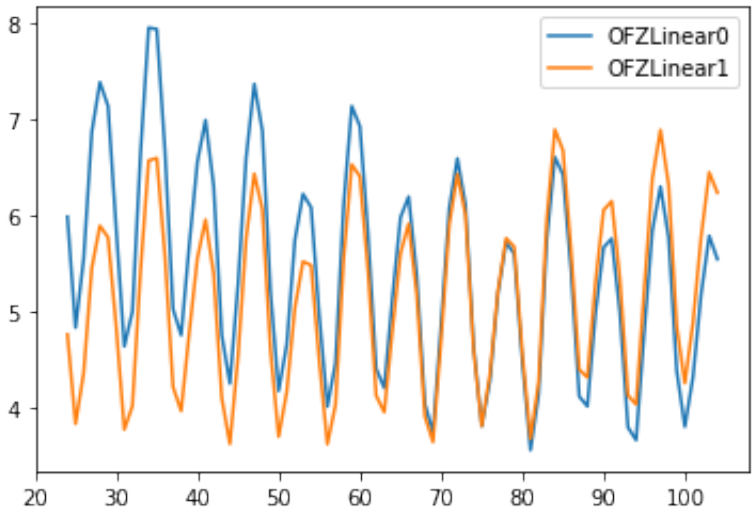

```
Smooth_60_-4_3_DDB2LK_res2.p
Rot_vel -4.0 60.0
Smooth_60_-4_3_DDB2LK_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.94724558273563 8.47918900918678 avg: 0.4680565735
4885  delta: 8.713217295961204
OFZLinear2-OFZLinear3 Avg: 6.626913018074086 6.370141339055088 avg: 0.25677167
9018998  delta: 6.498527178564587
OFZLinear4-OFZLinear5 Avg: 5.3075046921385285 5.13374822435519 avg: 0.17375646
77833383  delta: 5.220626458246859
```



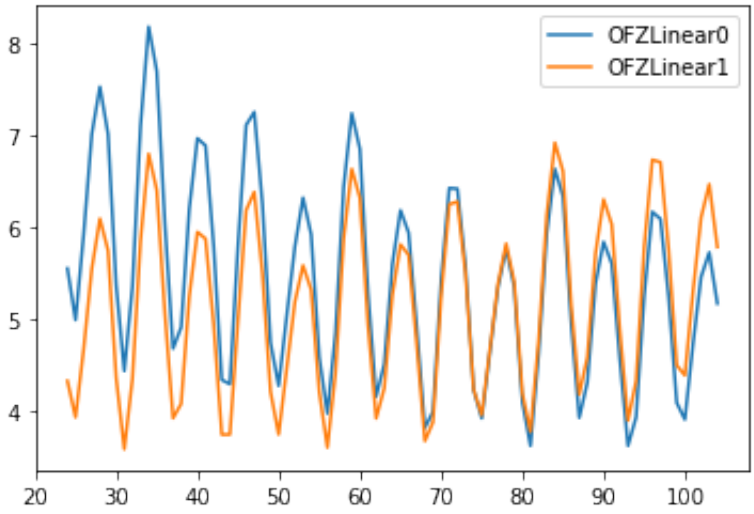

```
Smooth_60_-4_4_PPJSIF_res2.p
Rot_vel -4.0 60.0
Smooth_60_-4_4_PPJSIF_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.94737097247076 8.478974377184022 avg: 0.468396595
2867375  delta: 8.71317267482739
OFZLinear2-OFZLinear3 Avg: 6.628334627980398 6.370233535280652 avg: 0.25810109
269974646  delta: 6.499284081630525
OFZLinear4-OFZLinear5 Avg: 5.309421821126724 5.13566942127461 avg: 0.173752399
85211444  delta: 5.222545621200667
```



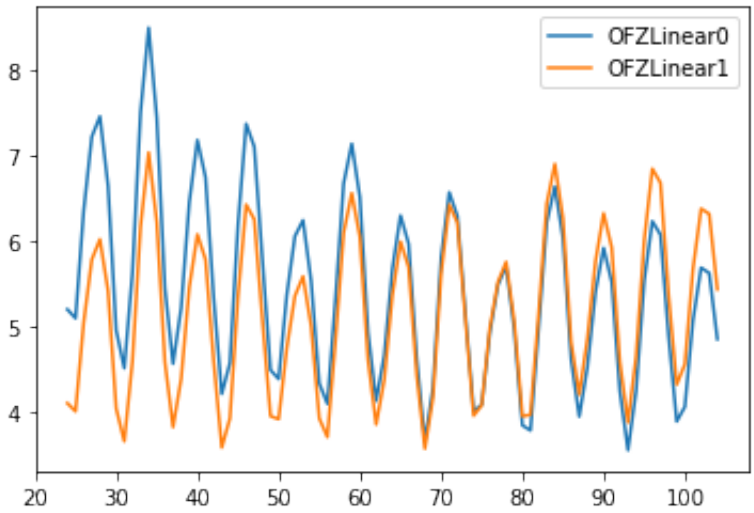

```
Smooth_60_-6_0_EO5Q0F_res2.p
Rot_vel -6.0 60.0
Smooth_60_-6_0_EO5Q0F_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.094522045008894 8.571210632623515 avg: 0.52331141
23853788  delta: 8.832866338816205
OFZLinear2-OFZLinear3 Avg: 6.7503453436166065 6.456634776801991 avg: 0.2937105
668146156  delta: 6.603490060209299
OFZLinear4-OFZLinear5 Avg: 5.409607250627021 5.220533376023086 avg: 0.18907387
460393466  delta: 5.315070313325053
```



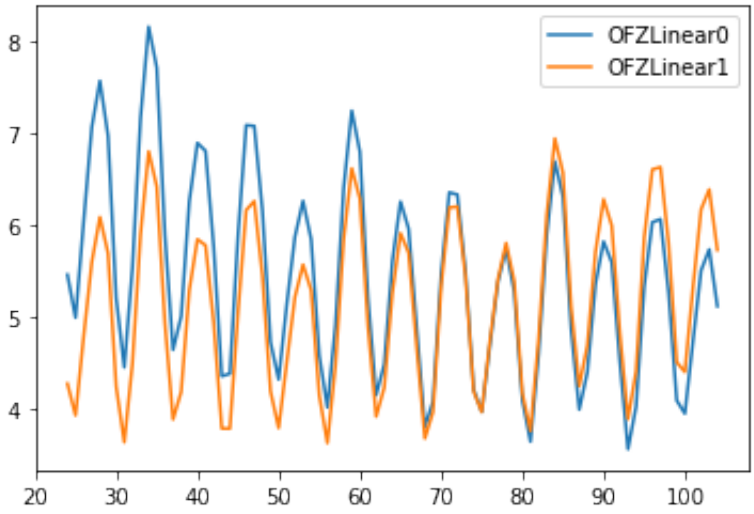

```
Smooth_60_-6_1_ITFYF8_res2.p
Rot_vel -6.0 60.0
Smooth_60_-6_1_ITFYF8_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.081849852570056 8.571361638842252 avg: 0.51048821
3727804  delta: 8.826605745706154
OFZLinear2-OFZLinear3 Avg: 6.737983487532855 6.453918963693112 avg: 0.28406452
3839743  delta: 6.595951225612984
OFZLinear4-OFZLinear5 Avg: 5.399003159100085 5.218399683927431 avg: 0.18060347
517265374  delta: 5.308701421513758
```



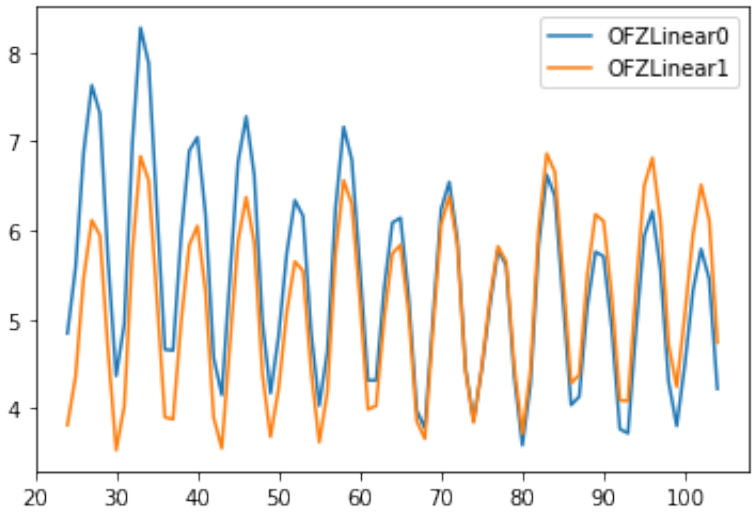

```
Smooth_60_-6_2_P77OMH_res2.p
Rot_vel -6.0 60.0
Smooth_60_-6_2_P77OMH_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.076642229761847 8.576439547772244 avg: 0.50020268
19896024  delta: 8.826540888767045
OFZLinear2-OFZLinear3 Avg: 6.7346706464454815 6.45731681669484 avg: 0.27735382
975064127  delta: 6.595993731570161
OFZLinear4-OFZLinear5 Avg: 5.397488194290401 5.217371265945265 avg: 0.18011692
834513582  delta: 5.307429730117833
```



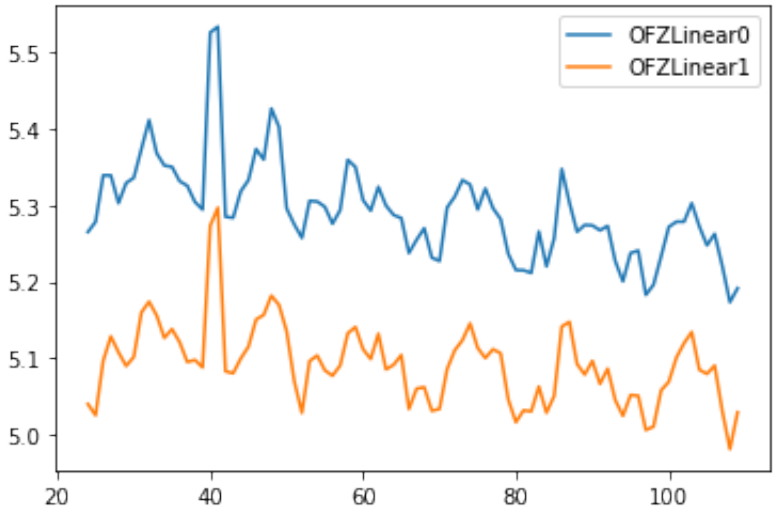

```
Smooth_60_-6_3_HY8MRS_res2.p
Rot_vel -6.0 60.0
Smooth_60_-6_3_HY8MRS_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.079773388873079 8.572509705549985 avg: 0.50726368
33230941  delta: 8.826141547211531
OFZLinear2-OFZLinear3 Avg: 6.7376844642487 6.455168395957404 avg: 0.2825160682
912955  delta: 6.596426430103052
OFZLinear4-OFZLinear5 Avg: 5.3996575986331745 5.217252573118283 avg: 0.1824050
2551489168  delta: 5.308455085875728
```



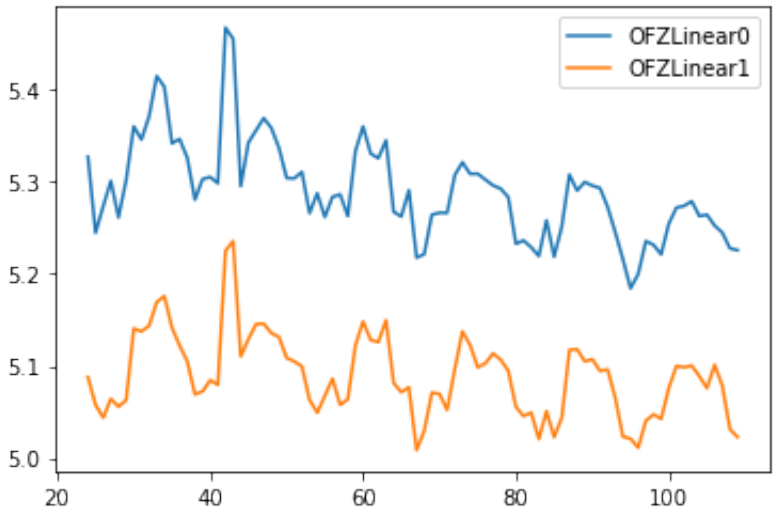

```
Smooth_60_-6_4_ONJJEZ_res2.p
Rot_vel -6.0 60.0
Smooth_60_-6_4_ONJJEZ_res3.p
(86, 27)
OFZLinear0-OFZLinear1 Avg: 9.054094576749728 8.572245270717364 avg: 0.48184930
60323643  delta: 8.813169923733547
OFZLinear2-OFZLinear3 Avg: 6.717709152989931 6.4506140413269355 avg: 0.2670951
116629956  delta: 6.584161597158433
OFZLinear4-OFZLinear5 Avg: 5.37686217523509 5.207533400365065 avg: 0.169328774
8700243  delta: 5.292197787800077
```



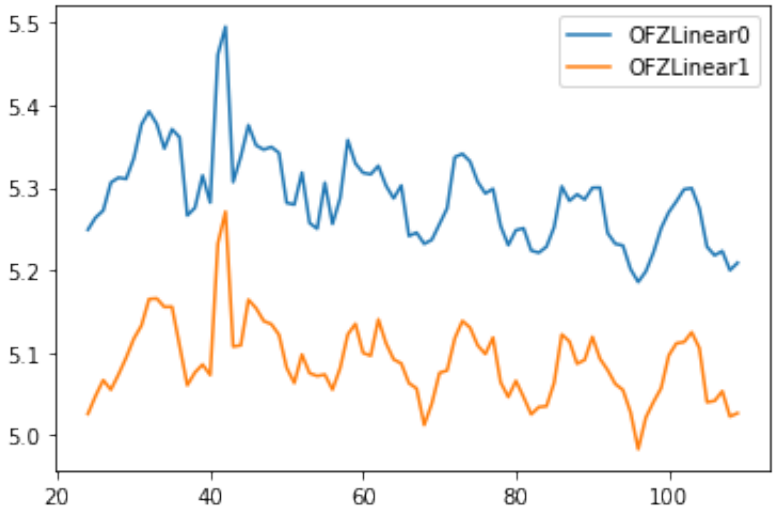

```
Smooth_60_0_0_6KASLJ_res2.p
Rot_vel 0.0 60.0
Smooth_60_0_0_6KASLJ_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.823400042777838 8.488332680029464 avg: 0.33506736
2748374  delta: 8.65586636140365
OFZLinear2-OFZLinear3 Avg: 6.570884585380554 6.403294025465499 avg: 0.16759055
991505534  delta: 6.4870893054230265
OFZLinear4-OFZLinear5 Avg: 5.298477938008863 5.17353381297385 avg: 0.124944125
03501273  delta: 5.236005875491356
```



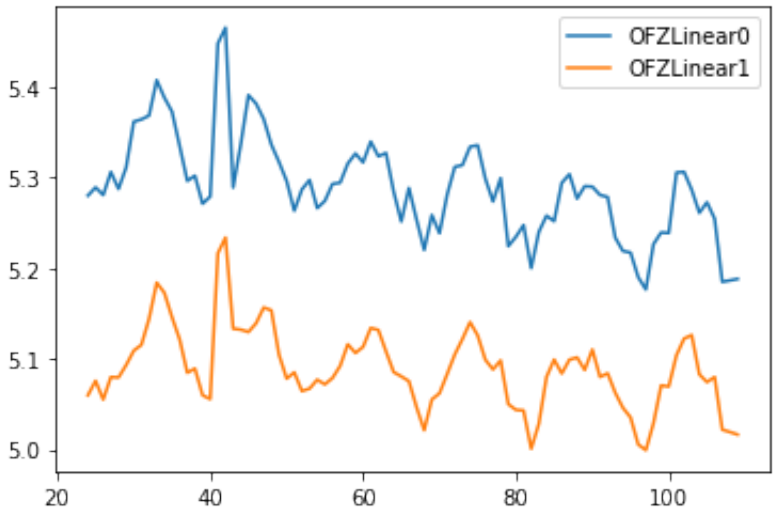

```
Smooth_60_0_1_H2CBPV_res2.p
Rot_vel 0.0 60.0
Smooth_60_0_1_H2CBPV_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.818434245826662 8.483322803364244 avg: 0.33511144
24624182  delta: 8.650878524595452
OFZLinear2-OFZLinear3 Avg: 6.564199000365973 6.397238840428433 avg: 0.16696015
99375401  delta: 6.480718920397203
OFZLinear4-OFZLinear5 Avg: 5.2930990716283635 5.167609300724296 avg: 0.1254897
7090406765  delta: 5.23035418617633
```



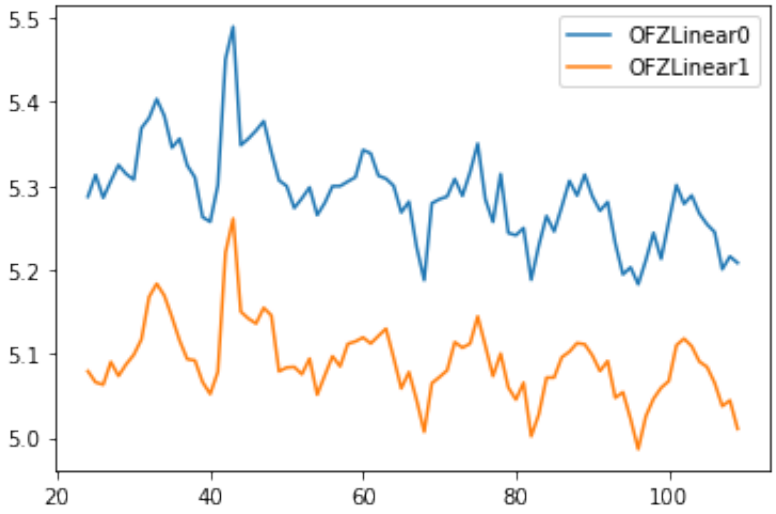

```
Smooth_60_0_2_HI1FZ4_res2.p
Rot_vel 0.0 60.0
Smooth_60_0_2_HI1FZ4_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.815657353216363 8.48202523335006 avg: 0.333632119
86630326  delta: 8.648841293283212
OFZLinear2-OFZLinear3 Avg: 6.56276035678479 6.3956697874290995 avg: 0.16709056
935569055  delta: 6.479215072106944
OFZLinear4-OFZLinear5 Avg: 5.291450407153876 5.1669899761214735 avg: 0.1244604
3103240267  delta: 5.229220191637674
```




```
Smooth_60_0_3_0IMBF0_res2.p
Rot_vel 0.0 60.0
Smooth_60_0_3_0IMBF0_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.816881863645804 8.482366282810537 avg: 0.33451558
083526756  delta: 8.649624073228171
OFZLinear2-OFZLinear3 Avg: 6.56217095463775 6.395212023757225 avg: 0.166958930
88052483  delta: 6.478691489197487
OFZLinear4-OFZLinear5 Avg: 5.291528794192528 5.16709119312523 avg: 0.124437601
06729851  delta: 5.2293099936588785
```



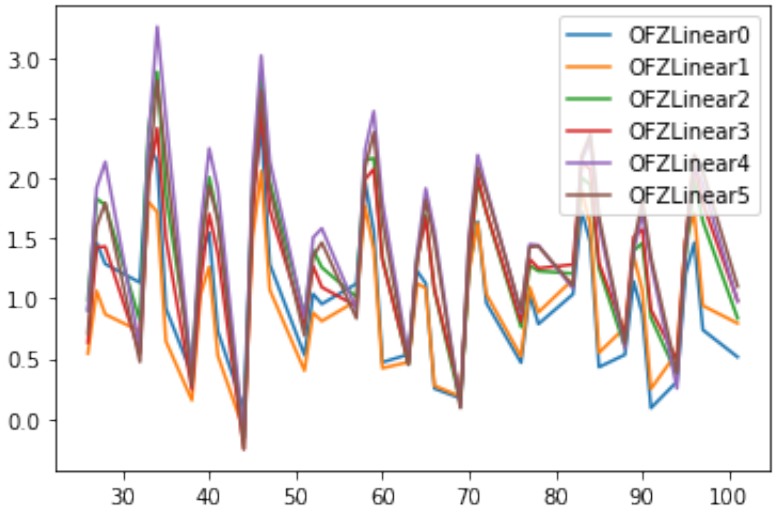

```
Smooth_60_0_4_XV9Y0W_res2.p
Rot_vel 0.0 60.0
Smooth_60_0_4_XV9Y0W_res3.p
(91, 27)
OFZLinear0-OFZLinear1 Avg: 8.817830344503239 8.483715260675712 avg: 0.33411508
382752686  delta: 8.650772802589476
OFZLinear2-OFZLinear3 Avg: 6.562480603077615 6.394740879073623 avg: 0.16773972
400399195  delta: 6.478610741075619
OFZLinear4-OFZLinear5 Avg: 5.291631106258363 5.167431480200715 avg: 0.12419962
605764745  delta: 5.229531293229539
```



In [417…

```
res[['OFZLinear0', 'OFZLinear1', 'OFZLinear2', 'OFZLinear3', 'OFZLinear4', 'O
```

Out[417… <AxesSubplot:>



In [413…
```
res.shape
```

Out[413… (33, 39)

In [ ]: