20_pandas

March 23, 2020

1 MDF Signal Analysis with Pandas.

pandas is a fast, powerful, flexible and easy to use open source data analysis and manipulation tool, built on top of the Python programming language.

- https://pandas.pydata.org/

The example below is a quick start tutorial for getting MDF data into pandas. There is minimal data analysis and plotting below that.

Additional pandas analysis resources:

- Articles:
  - 10 minutes to pandas
    This is a short introduction to pandas, geared mainly for new users. You can see more complex recipes in the Cookbook.
  - Python Pandas Tutorial: A Complete Introduction for Beginners
    Learn some of the most important pandas features for exploring, cleaning, transforming, visualizing, and learning from data.
  - pandas Cookbook.
    Short and sweet examples and links for useful pandas recipes.
- Videos:
  - Complete Python Pandas Data Science Tutorial! (Reading CSV/Excel files, Sorting, Filtering, Groupby) [01:00:26]
  - Intro to Data Analysis / Visualization with Python, Matplotlib and Pandas | Matplotlib Tutorial

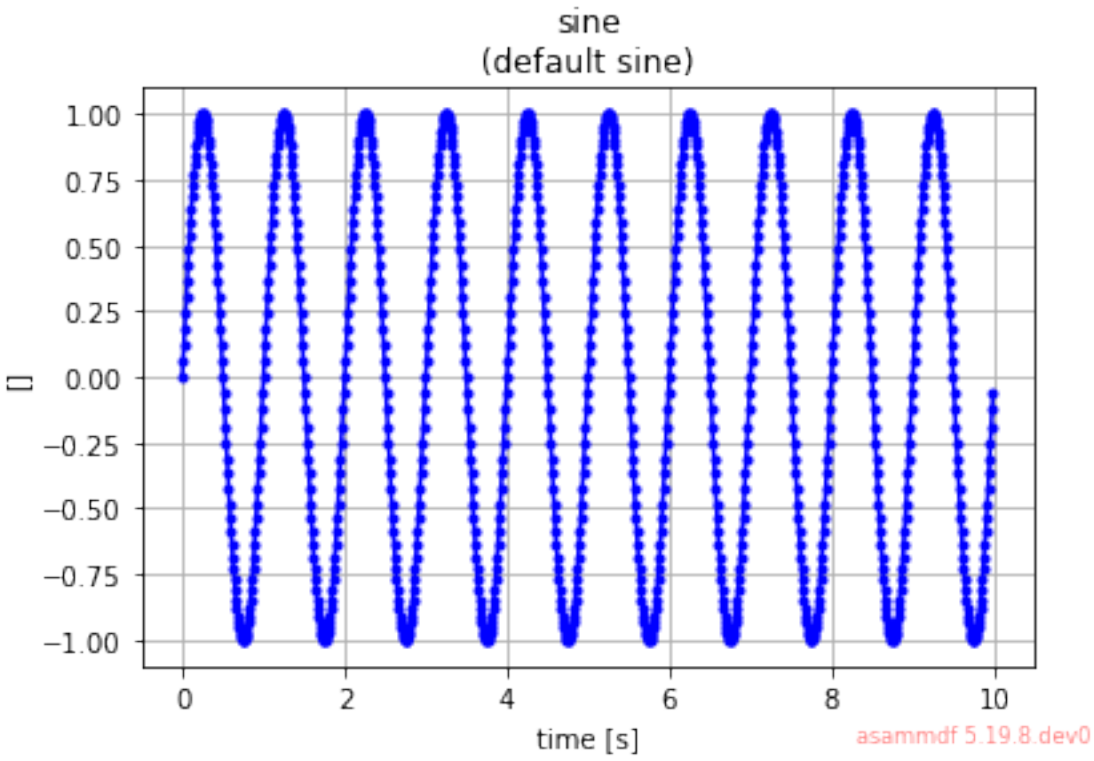
[1]:
```
from asammdf import MDF
# Signals generated in 90_BasicSignals.
mdf = MDF("90_BasicSignals.mf4")
```

1.1 Plot

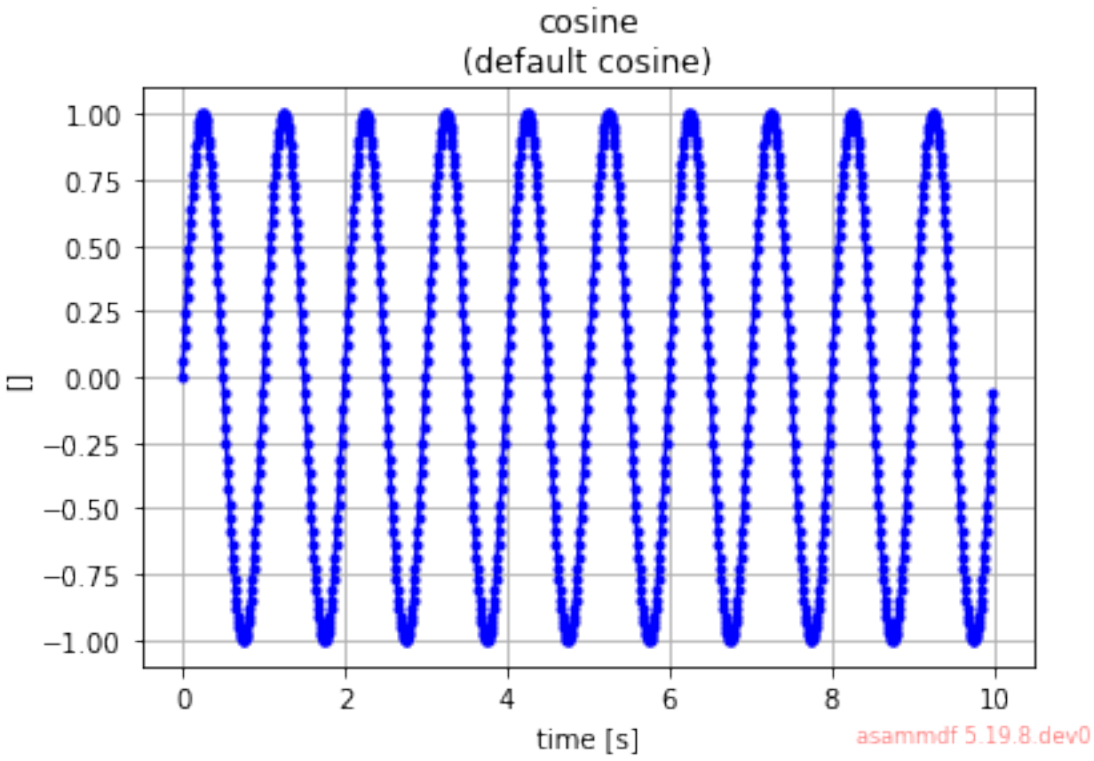
Plot each of the channels through `asammdf`.

[2]:
```
for channel in mdf.iter_channels():
    channel.plot()
```

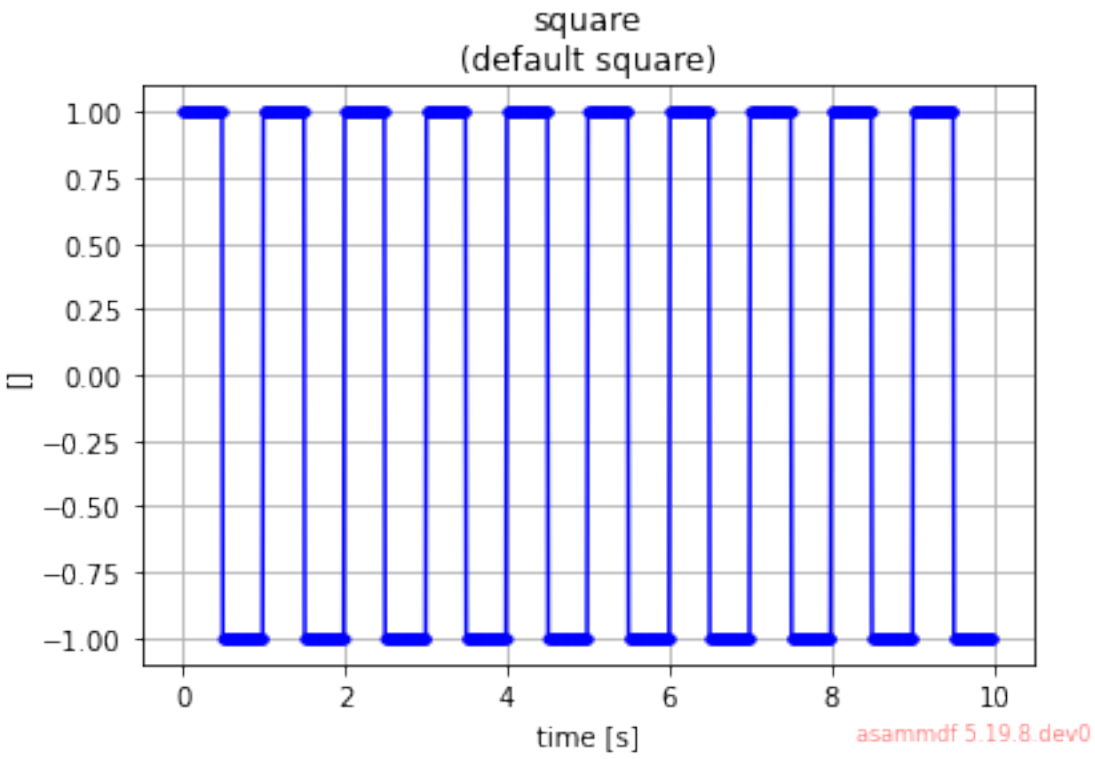
```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```



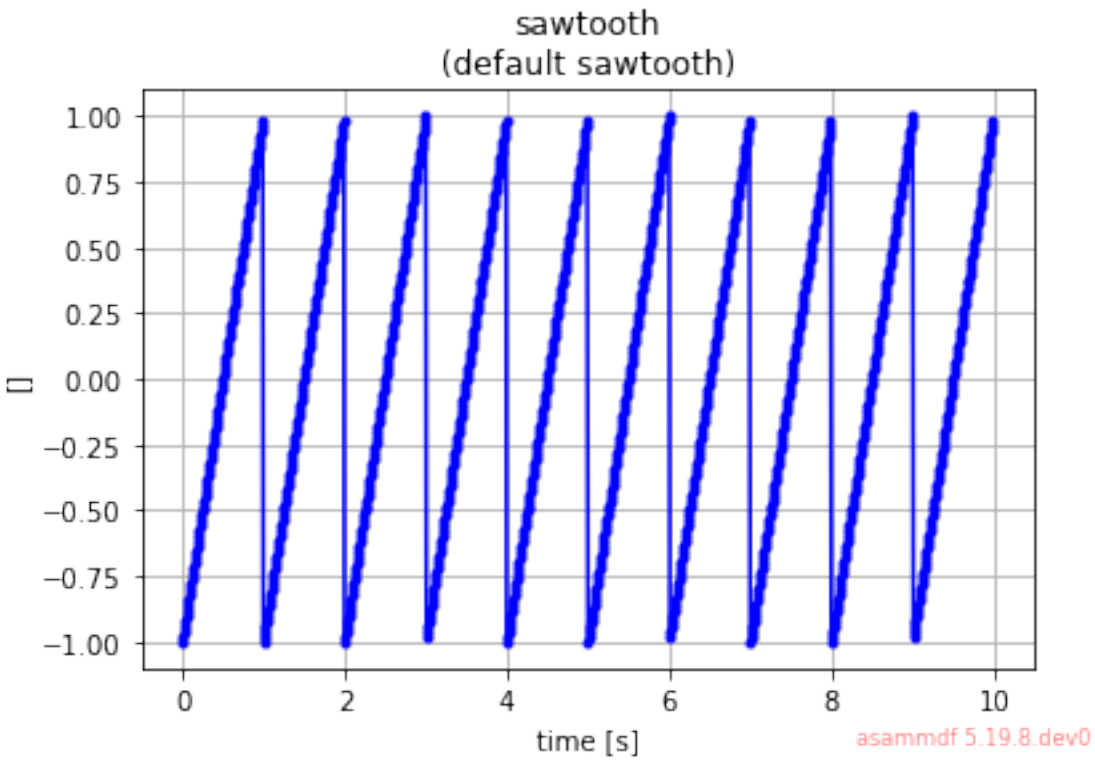

```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```



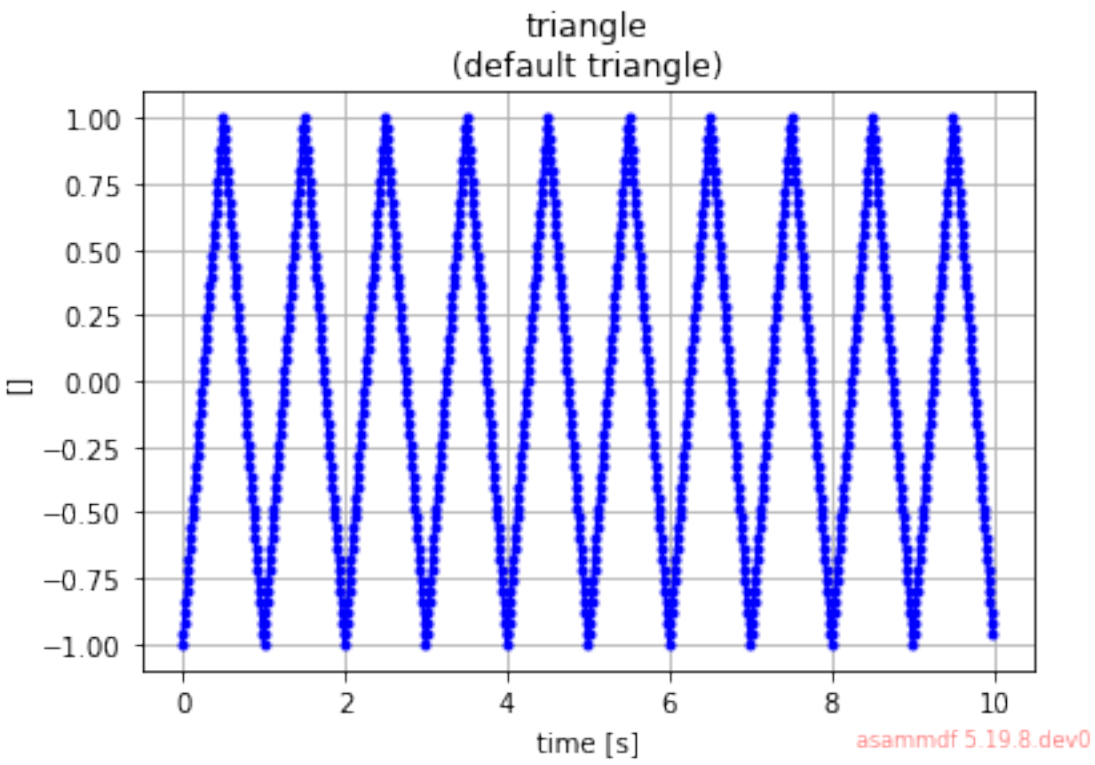

```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```



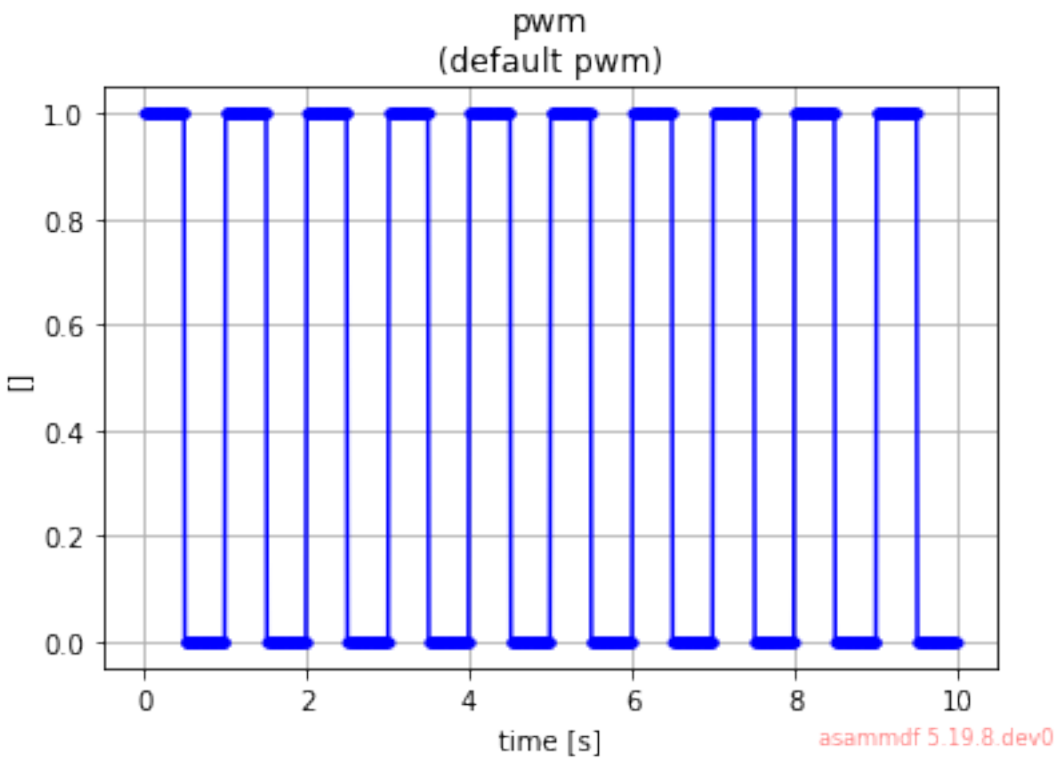

```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```



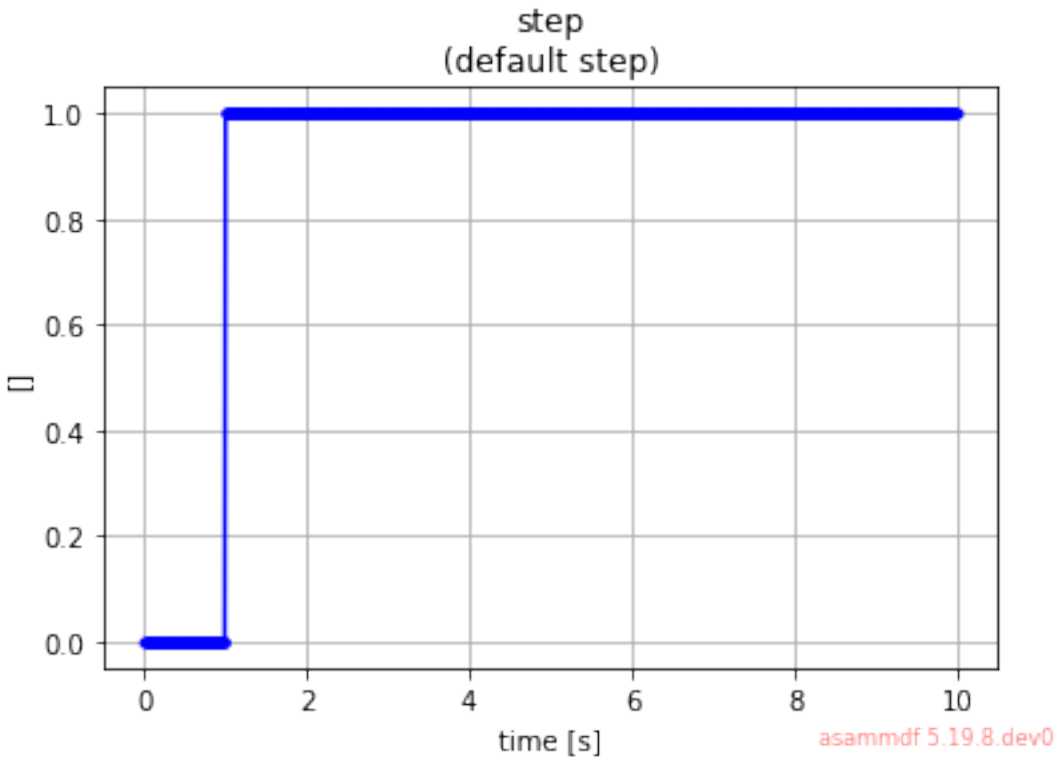

```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```




```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```




```
WARNING:root:Signal plotting requires pyqtgraph or matplotlib
```



2 Convert to pandas DataFrame

[3]:
```
df = mdf.to_dataframe()
```

[4]:
```
df
```

[4]:

timestamps	sine	cosine	square	sawtooth	triangle	pwm	step
0.000000	0.000000	0.000000	1.0	-1.000000	-1.000000	1.0	0.0
0.010000	0.062791	0.062791	1.0	-0.980000	-0.960000	1.0	0.0
0.020000	0.125333	0.125333	1.0	-0.960000	-0.920000	1.0	0.0
0.030000	0.187381	0.187381	1.0	-0.940000	-0.880000	1.0	0.0
0.040000	0.248690	0.248690	1.0	-0.920000	-0.840000	1.0	0.0
…	…	…	…	…	…	…	…
9.950000	-0.309018	-0.309018	-1.0	0.899999	-0.799998	0.0	1.0
9.960000	-0.248687	-0.248687	-1.0	0.920000	-0.840001	0.0	1.0
9.969999	-0.187382	-0.187382	-1.0	0.939999	-0.879998	0.0	1.0
9.980000	-0.125334	-0.125334	-1.0	0.959999	-0.919998	0.0	1.0
9.990000	-0.062792	-0.062792	-1.0	0.979999	-0.959998	0.0	1.0

[1000 rows x 7 columns]

Generate descriptive statistics.
Descriptive statistics include those that summarize the central tendency, dispersion and shape of a dataset's distribution, excluding NaN values.
- pandas.DataFrame.describe

[5]:
```
df.describe()
```

[5]:
```
                sine        cosine       square      sawtooth      triangle  \
count   1.000000e+03  1.000000e+03  1000.000000  1.000000e+03  1.000000e+03
mean    1.907349e-09  1.907349e-09     0.002000 -4.000228e-03 -9.597974e-09
std     7.074606e-01  7.074606e-01     1.000498  5.776830e-01  5.778701e-01
min    -1.000000e+00 -1.000000e+00    -1.000000 -1.000000e+00 -1.000000e+00
25%    -6.956536e-01 -6.956536e-01    -1.000000 -5.000001e-01 -4.900004e-01
50%    -1.192488e-08 -1.192488e-08     1.000000 -5.960464e-08  0.000000e+00
75%     6.956536e-01  6.956536e-01     1.000000  4.999998e-01  4.900009e-01
max     1.000000e+00  1.000000e+00     1.000000  9.999999e-01  9.999999e-01

                pwm         step
count   1000.000000  1000.00000
mean       0.501000     0.90000
std        0.500249     0.30015
min        0.000000     0.00000
25%        0.000000     1.00000
50%        1.000000     1.00000
75%        1.000000     1.00000
max        1.000000     1.00000
```

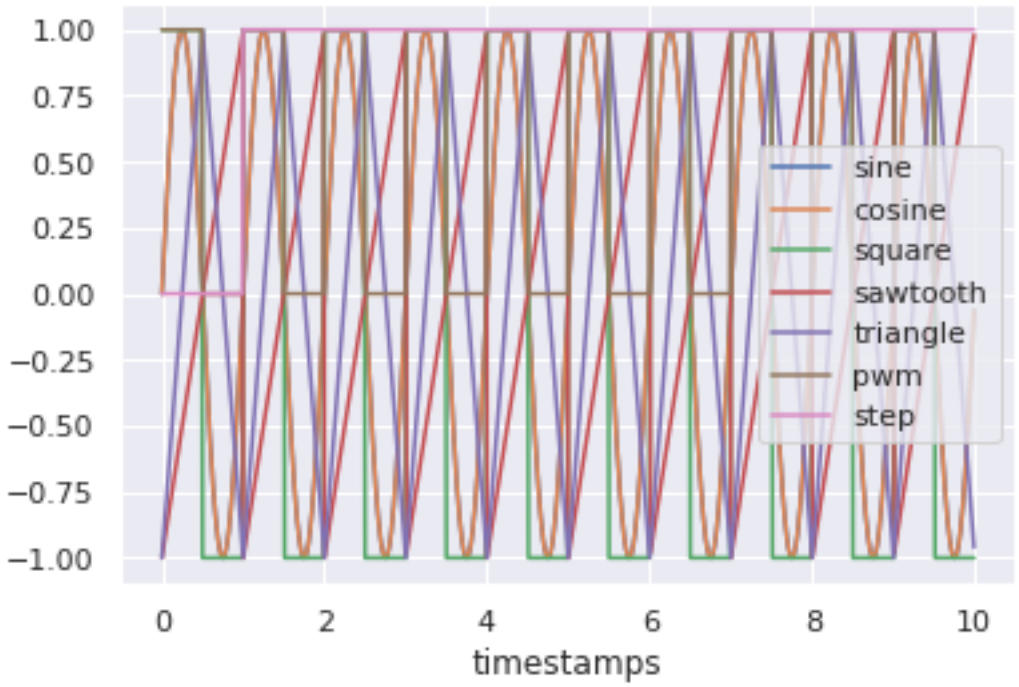
2.1 Plotting

[6]:
```
import seaborn as sns
sns.set()
```

Plot the pandas dataframe, all signals on the same plot.

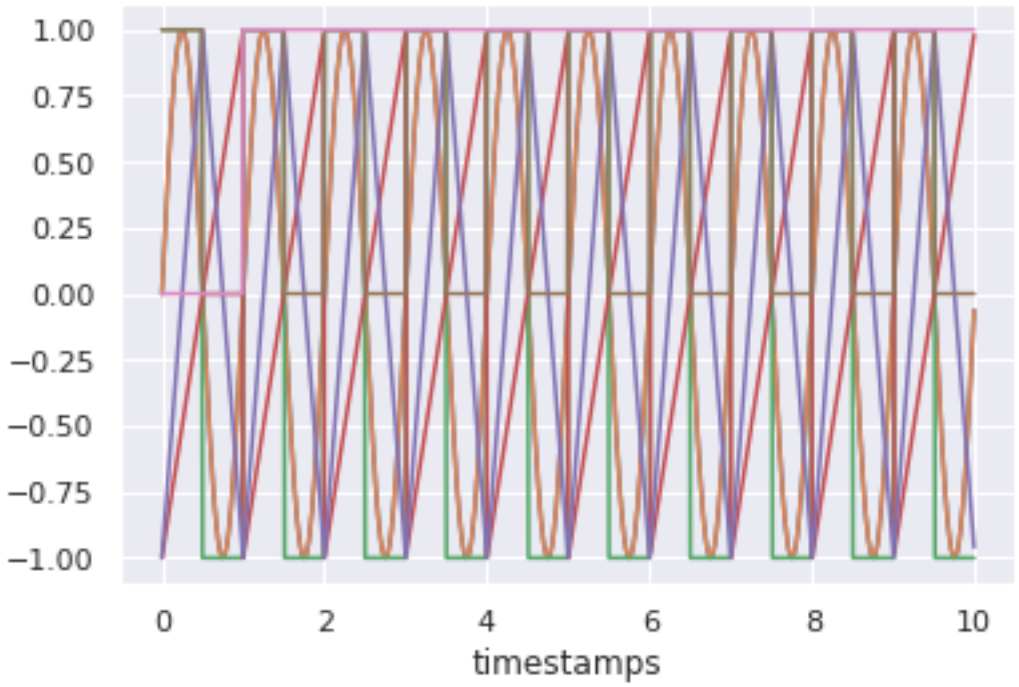
[7]:
```
df.plot()
```

[7]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f3562d0b2e0>
```



Plot the signal in a loop on the same plot.

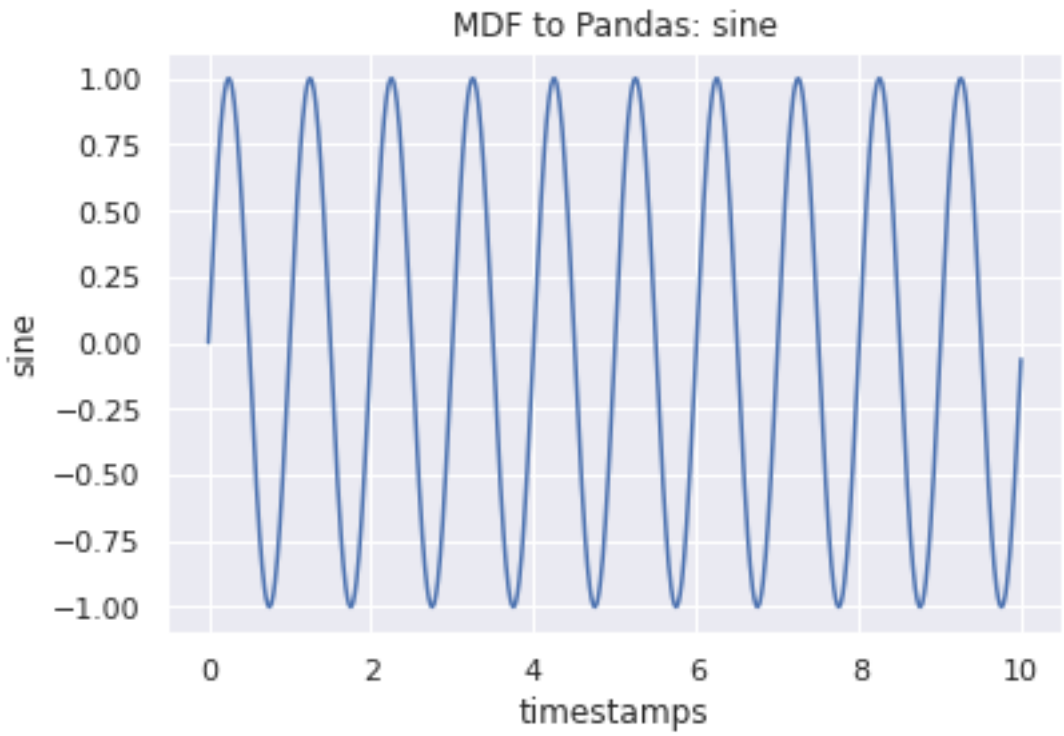
[8]:
```
for signal_name in df.columns:
    signal = getattr(df, signal_name)
    signal.plot()
```

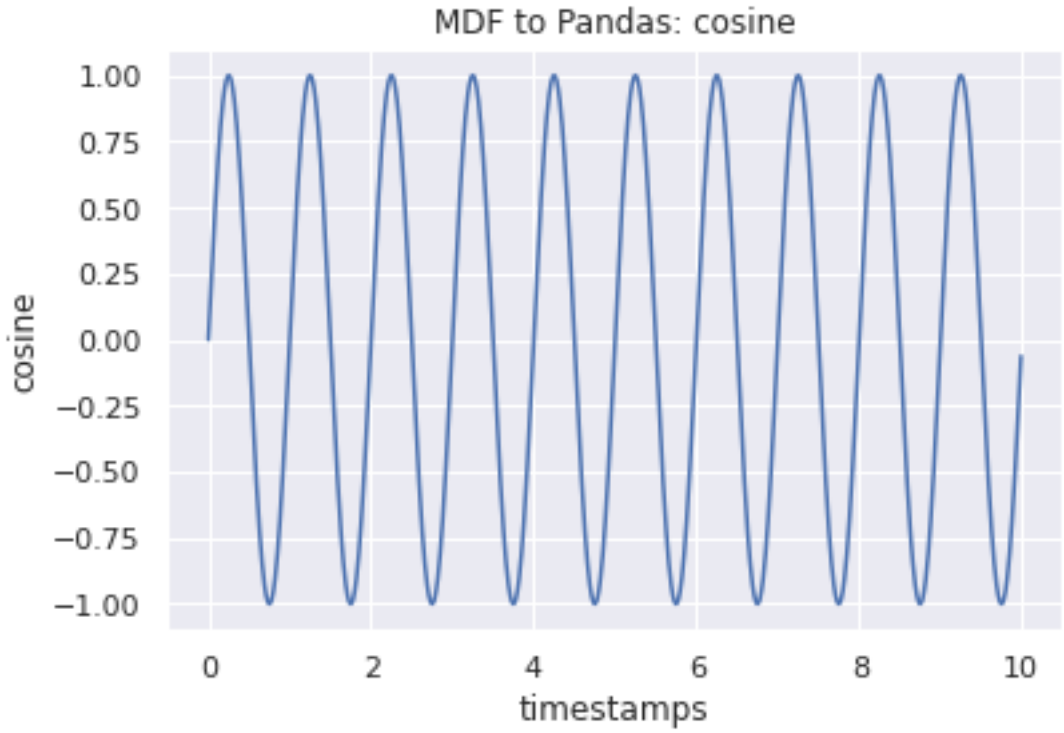


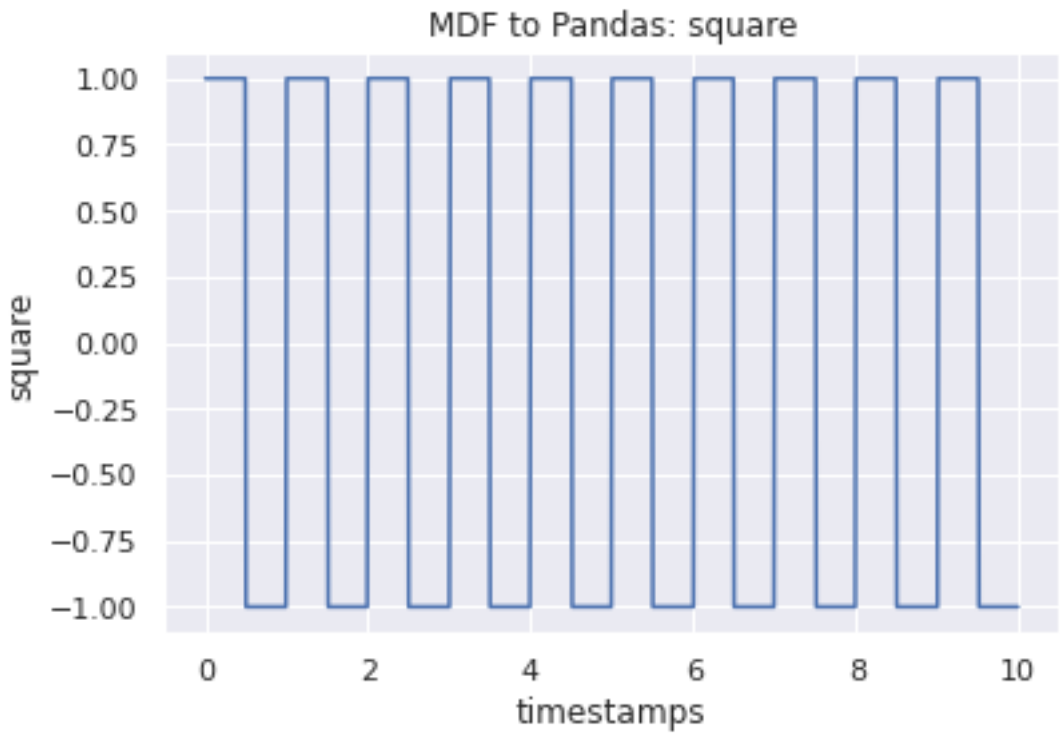
Plot the signals on a new figure in a loop with title, ylabel

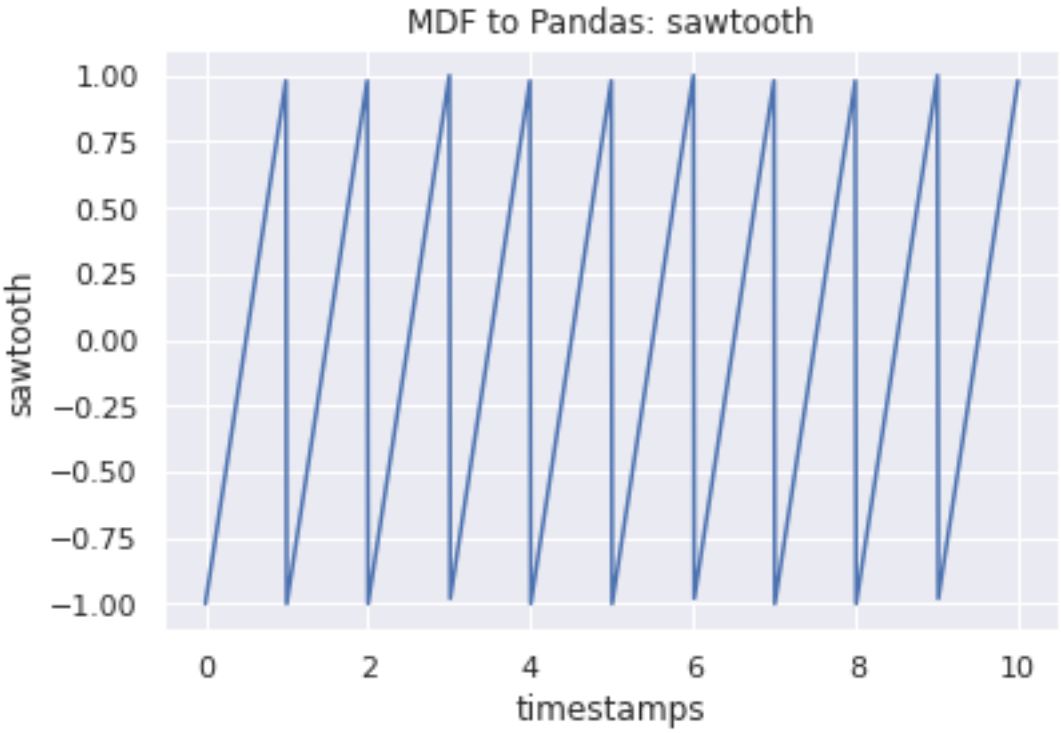
[9]:
```
import matplotlib.pyplot as plt
```

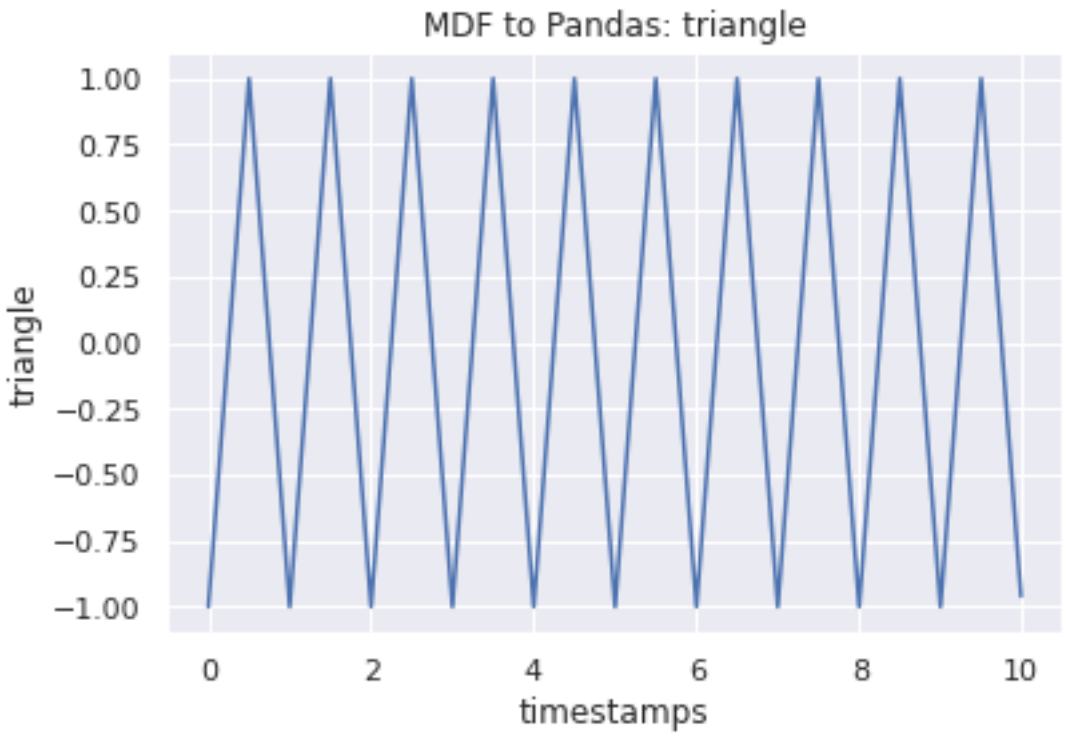
[10]:
```
for signal_name in df.columns:
    signal = getattr(df, signal_name)
    signal.plot()
    plt.ylabel(signal_name)
    plt.title(f"MDF to Pandas: {signal_name}")
    plt.show()
```

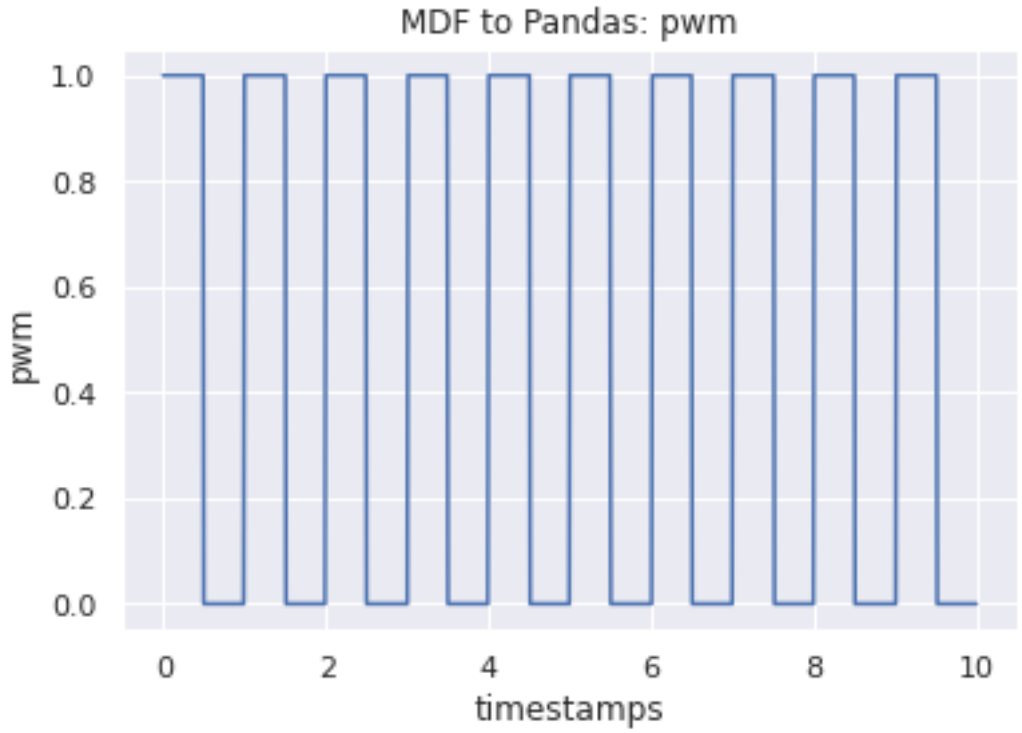

MDF to Pandas: sine
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
sine
0
2
4
6
8
10
timestamps

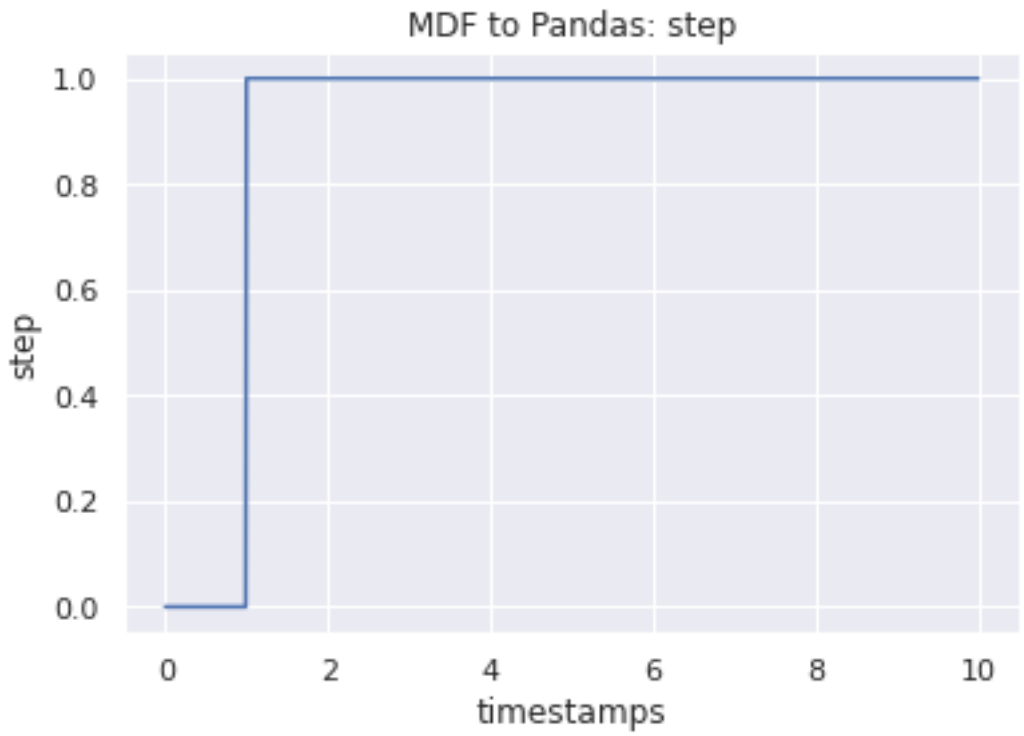

MDF to Pandas: cosine
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
cosine
0
2
4
6
8
10
timestamps


MDF to Pandas: square
square
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
2
4
6
8
10
timestamps


MDF to Pandas: sawtooth
sawtooth
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
2
4
6
8
10
timestamps


MDF to Pandas: triangle
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
triangle
0
2
4
6
8
10
timestamps


MDF to Pandas: pwm
1.0
0.8
0.6
0.4
0.2
0.0
pwm
0
2
4
6
8
10
timestamps


MDF to Pandas: step
1.0
0.8
0.6
0.4
0.2
0.0
step
0
2
4
6
8
10
timestamps

[ ]: