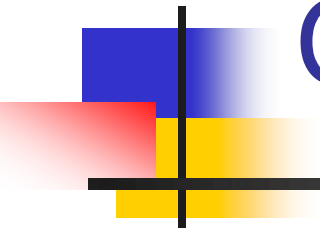
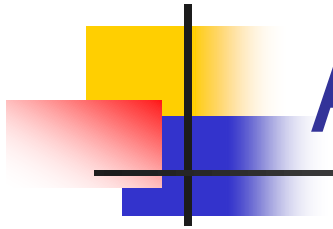


Computer Methods (MAE 3403)

Create a movie/animation



Add animations or movies

- Animation is a sequence of still frames, displayed fast enough in sequence to illustrate continuous motion.

- If you can plot, you can create an animation
  - Calling a plot function in a for loop
  - Use matplotlib.animation as a base class to create a movie

How?

- Before making a movie:
  - Define the meta data of the movie
  - Decide what in the background that does not change
  - Decide what objects will change in each frame
  - You may choose “html” or “pillow” (.gif file) as movieWriter.

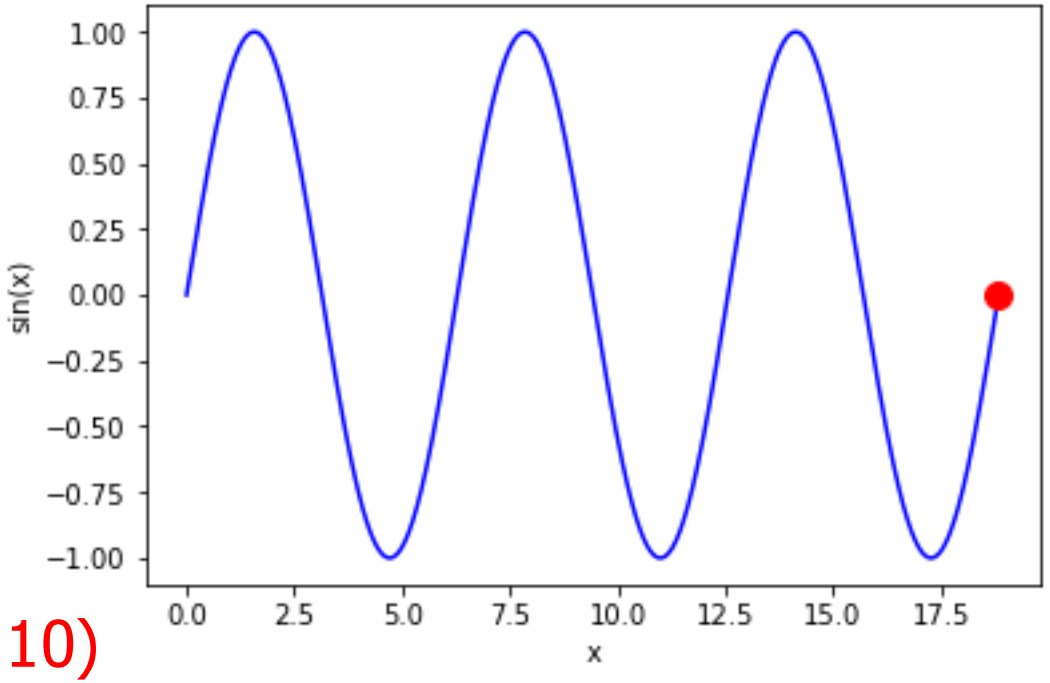
```
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.animation as manimation
movieWriter = manimation.writers[‘pillow’]
metadata = dict(title='Movie Test', artist='Matplotlib',
comment='a red circle following a blue sine wave’)
writer = movieWriter(fps=15, metadata=metadata)
```

fps: frame per second

Initialize the movie background

```
n = 1000
x = np.linspace(0, 6*np.pi, n)
y = np.sin(x)

fig = plt.figure()
# plot the sine wave line
sine_line, = plt.plot(x, y, 'b')
# plot the place holder (empty) red dot
red_circle, = plt.plot([], [], 'ro', markersize = 10)
plt.xlabel('x')
plt.ylabel('sin(x)')
```

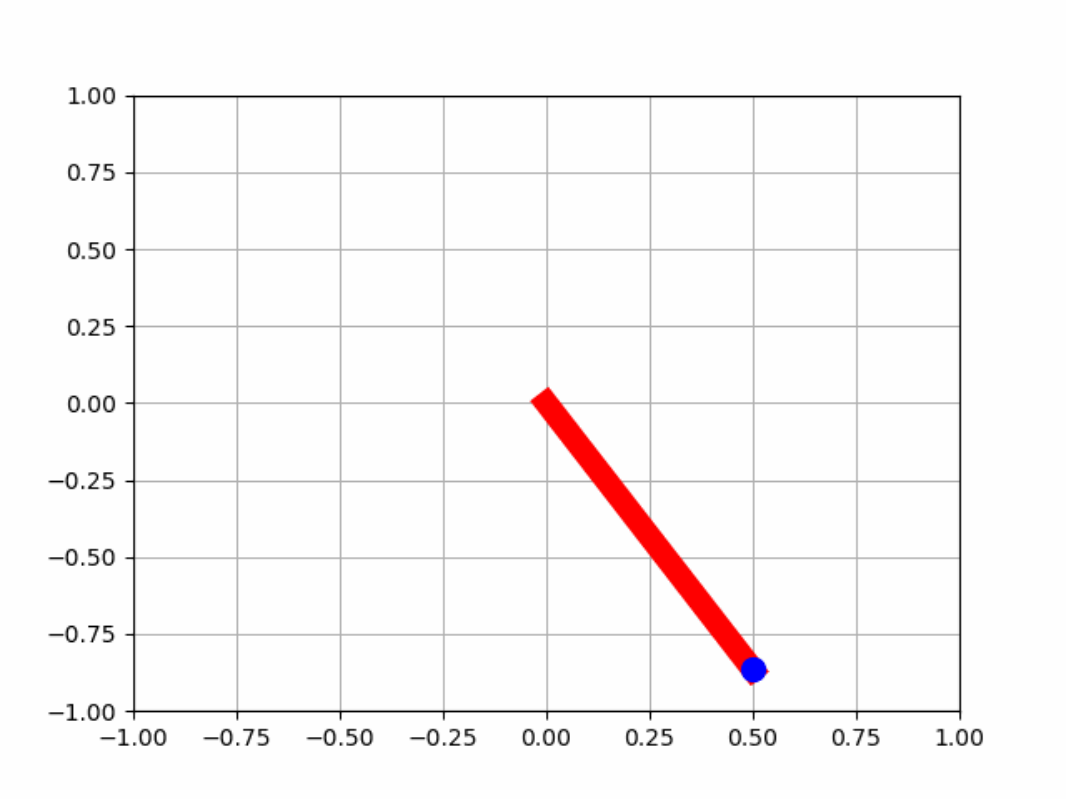


Update the frames for the movie

```
with writer.saving(fig, "writer_test.gif", 100):
        for i in range(n):
              x0 = x[i]
             y0 = y[i]
              red_circle.set_data(x0, y0)
             writer.grab_frame()
```

- 100 is the dpi (dots per inch) of the figure
- grab_frame function captures changes in each frame and display it based on the fps we set.
- Let's run it.

Try creating a gif of a pendulum



- Dynamics:

$$ml\frac{d^2\theta(t)}{dt^2} = -mg\sin(\theta(t)).$$

$$S = \begin{pmatrix}\theta\\ \dot{\theta}\end{pmatrix},\ \dot{S} = \begin{pmatrix}\dot{\theta}\\ \ddot{\theta}\end{pmatrix} = \begin{pmatrix}S_2\\ -\frac{g}{\ell}\sin(S_1)\end{pmatrix}$$

- ic=[initial angle, initial speed]
- For each $\theta(t)$, draw a line with length l