

PYTHON EXAMPLES

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1. STREAMPLOTS

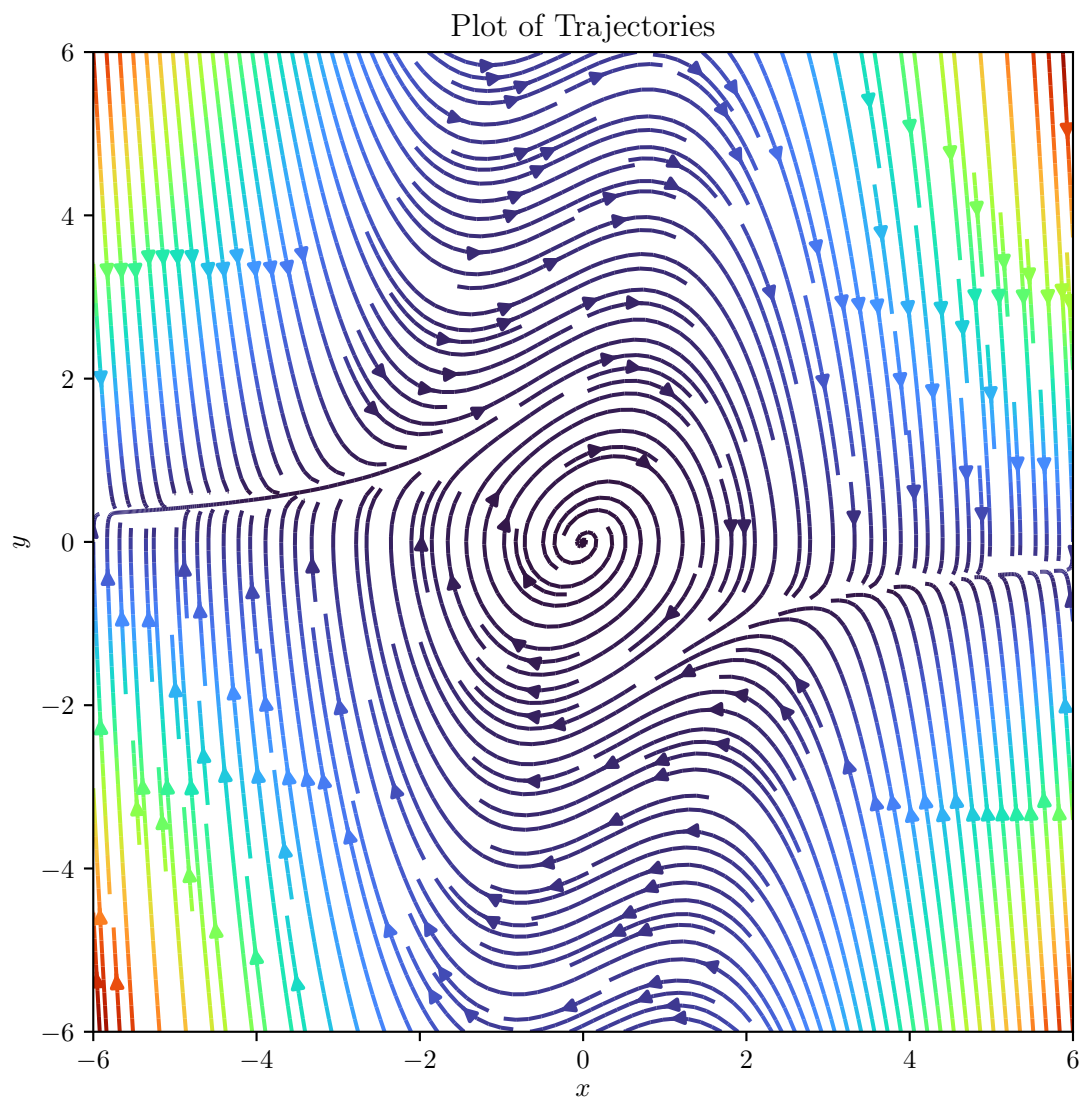


FIGURE 1. This is a plot of the Van der Pol system with $\epsilon = 0.5$. Note that the pgf format creates vector images that can be zoomed.

```

1  """
2  streamplot.py
3  By William Black
4
5  This script outputs a streamplot for the Van der Pol system to pgf
   to be used in LaTeX.
6  """
7  import numpy as np
8  import matplotlib.pyplot as plt
9  from numpy.linalg import norm
10
11 plt.rcParams.update({ ## This will make the plots render in native
   LaTeX in your PDF.
12     "text.useTex": True,
13     "font.family": "serif",
14     "pgf.texsystem" : "pdflatex",
15     "axes.unicode_minus" : False,
16     "text.latex.preamble" : r"\usepackage{amsmath,amsfonts,amssymb,
       mathtools}"
17 })
18
19 def vanderpol(x, y, eps=1.): ## Default value of 1. for eps
20     return np.stack([y,
21                     eps * (1 - x**2) * y - x])
22
23
24 if __name__ == "__main__":
25     xlim = (-6., 6.)
26     ylim = (-6., 6.)
27     N = 20 ## Number of gridpoints per dimension
28
29     X = np.linspace(*xlim, num=1+N) ## Using the unpacking operator
   *
30     Y = np.linspace(*ylim, num=1+N)
31
32     Xg, Yg = np.meshgrid(X, Y) ## g for grid
33
34     Xv, Yv = vanderpol(Xg, Yg, eps=0.5)
35
36     color = norm(np.stack([Xv, Yv]), ord=2, axis=0)
37
38     plt.figure(figsize=(6., 6.))
39     plt.gca().set_aspect("equal", adjustable="box")
40
41     plt.xlim(*xlim)
42     plt.ylim(*ylim)
43
44     plt.streamplot(
45         X,

```

```
46         Y,
47         Xv,
48         Yv,
49         density=2.5,
50         arrowsize=1.,
51         color=color,
52         cmap=plt.get_cmap("turbo")
53     )
54
55     plt.xlabel("$x$")
56     plt.ylabel("$y$")
57     plt.title("Plot of Trajectories")
58     plt.tight_layout()
59     plt.savefig("streamplot.pgf") ## You can change pgf to png or
        other formats
```