5. scipy

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1 El módulo scipy

scipy es un módulo para cómputo científico, basado en numpy

Provee rutinas de distintas índoles

```
In [3]: import scipy

In [1]: from scipy import optimize

In [2]: from scipy import linalg

In [3]: from scipy import random

In [5]: from scipy import signal

In [6]: signal?

In [7]: from scipy import optimize

In [9]: def f(x):
            return x**2 - 2.

In [10]: f

Out[10]: <function __main__.f>

In [11]: optimize.newton(f, 1.)

Out[11]: 1.4142135623730947

In [12]: def g(x, y):
             return (x**2 - 2)*(y**2 - 3)

In [15]: import numpy as np

In [16]: np.r_[3., 7.]

Out[16]: array([ 3.,  7.])

In [20]: optimize.newton_krylov(g, np.r_[3., 7.])
```

```
        ---------------------------------------------------------------------------
    TypeError                                 Traceback (most recent call last)

        <ipython-input-20-9fc0d05ebf8e> in <module>()
    ----> 1 optimize.newton_krylov(g, np.r_[3., 7.])
```

```
/usr/local/Cellar/python/2.7.5/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packa


/usr/local/Cellar/python/2.7.5/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packa
    271
    272         dx = np.inf
--> 273         Fx = func(x)
    274         Fx_norm = norm(Fx)
    275


/usr/local/Cellar/python/2.7.5/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packa
    267
    268         x0 = _as_inexact(x0)
--> 269         func = lambda z: _as_inexact(F(_array_like(z, x0))).flatten()
    270         x = x0.flatten()
    271


TypeError: g() takes exactly 2 arguments (1 given)
```

```
In [18]: optimize.newton?
```

```
In [19]: optimize.newton_krylov(
```

1.1 Ecuaciones diferenciales ordinarias

```
In [21]: from scipy import integrate
```

`integrate.ode` es más flexible pero más complicado de usar que `integrate.odeint`
Primero, resolvamos $\dot{x} = -x$

```
In [26]: def f(x, t):
             return -x
```

```
In [31]: tiempos = np.arange(0, 2, 0.1)
```

```
In [28]: resultado = integrate.odeint(f, 1., tiempos)
```

```
In [30]: integrate.odeint?
```

```
In [29]: resultado
```

```
Out[29]: array([[  1.00000000e+00],
                [  9.04837446e-01],
                [  8.18730770e-01],
                [  7.40818203e-01],
                [  6.70320057e-01],
                [  6.06530671e-01],
                [  5.48811654e-01],
                [  4.96585321e-01],
                [  4.49328982e-01],
                [  4.06569679e-01],
                [  3.67879469e-01],
                [  3.32871094e-01],
                [  3.01194215e-01],
                [  2.72531795e-01],
                [  2.46596965e-01],
                [  2.23130159e-01],
                [  2.01896517e-01],
                [  1.82683522e-01],
                [  1.65298883e-01],
                [  1.49568612e-01],
                [  1.35335274e-01],
                [  1.22456418e-01],
                [  1.10803148e-01],
                [  1.00258832e-01],
                [  9.07179414e-02],
                [  8.20849868e-02],
                [  7.42735658e-02],
                [  6.72055007e-02],
                [  6.08100508e-02],
                [  5.50232065e-02],
                [  4.97870568e-02],
                [  4.50491965e-02],
                [  4.07622002e-02],
                [  3.68831661e-02],
                [  3.33732684e-02],
                [  3.01973821e-02],
                [  2.73237215e-02],
                [  2.47235259e-02],
                [  2.23707711e-02],
                [  2.02419106e-02],
                [  1.83156385e-02],
                [  1.65726752e-02],
                [  1.49955769e-02],
                [  1.35685591e-02],
                [  1.22773403e-02],
                [  1.11089969e-02],
                [  1.00518364e-02],
                [  9.09527768e-03],
                [  8.22974772e-03],
                [  7.44658368e-03],
                [  6.73794773e-03],
                [  6.09674723e-03],
                [  5.51656514e-03],
                [  4.99159456e-03],
                [  4.51658163e-03],
                [  4.08677206e-03],
                [  3.69786438e-03],
                [  3.34596606e-03],
                [  3.02755535e-03],
                [  2.73944546e-03],
                [  2.47875313e-03],
                [  2.24286863e-03],
                [  2.02943141e-03],
                [  1.83630536e-03],
                [  1.66155734e-03],
                [  1.50343882e-03],
                [  1.36036753e-03],
                [  1.23091109e-03],
                [  1.11377442e-03],
                [  1.00778450e-03],
                [  9.11881103e-04],
                [  8.25103962e-04],
                [  7.46584859e-04],
                [  6.75537868e-04],
                [  6.11251831e-04],
                [  5.53083432e-04],
                [  5.00450183e-04],
                [  4.52826007e-04],
                [  4.09733842e-04],
                [  3.70742439e-04],
                [  3.35461687e-04],
                [  3.03538160e-04],
                [  2.74652695e-04],
                [  2.48515954e-04],
                [  2.24866444e-04],
                [  2.03467611e-04],
                [  1.84105060e-04],
                [  1.66585170e-04],
                [  1.50732456e-04],
                [  1.36388245e-04],
                [  1.23409253e-04],
                [  1.11665262e-04],
                [  1.01038893e-04],
                [  9.14235587e-05],
                [  8.27231349e-05],
                [  7.48509882e-05],
                [  6.77282533e-05],
                [  6.12834864e-05],
                [  5.54518234e-05],
                [  5.01752362e-05]])
```

```
In [32]: def armonico(xvec, t):
             x, y = xvec
             return (y, -4*x)
```

```
In [34]: armonico([1, 0], 0)
```

```
Out[34]: (0, -4)
```

```
In [35]: integrate.odeint(armonico, np.r_[1, 0], tiempos)
```

```
Out[35]: array([[ 1.        ,  0.        ],
                [ 0.98006658, -0.39733865],
                [ 0.92106099, -0.77883667],
                [ 0.82533562, -1.12928493],
                [ 0.69670672, -1.43471216],
                [ 0.54030232, -1.68294195],
                [ 0.36235777, -1.86407815],
                [ 0.16996716, -1.97089944],
                [-0.0291995 , -1.9991472 ],
                [-0.22720206, -1.94769526],
                [-0.4161468 , -1.81859488],
                [-0.58850109, -1.61699285],
                [-0.7373937 , -1.35092641],
                [-0.85688874, -1.03100281],
                [-0.94222234, -0.66997637],
                [-0.98999251, -0.28224009],
                [-0.9982948 ,  0.11674821],
                [-0.96679823,  0.51108214],
                [-0.89675847,  0.88504084],
                [-0.79096778,  1.22371576]])
```

```
In [36]: integrate.ode?
```

```
In [ ]:
```