

## ESCUOLA POLITÉCNICA NACIONAL

FACULTAD DE INGENIERÍA EN SISTEMAS

METODOS NUMERICOS ICCD412

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TALLER 30 METODOS ITERATIVOS

GR1CC

FECHA DE ENTREGA 20 DE ENERO DEL 2026

```
In [45]: %load_ext autoreload
%autoreload
from __future__ import elimination_gaussiana, gauss_jacobi, gauss_seidel
import numpy as np

The autoreload extension is already loaded. To reload it, use:
%reload_ext autoreload

In [46]: gauss_jacobi(AxA, bxb, x=0) * n, tol=1e-5, max_iter=10, return_traj=True # type: ignore
gauss_seidel(AxA, bxb, x=0) * n, tol=1e-5, max_iter=10, return_traj=True # type: ignore

[0-21 111:948] [INFO] [print]: i= 0 x: [[0, 0, 1]
[0-21 111:948] [INFO] [print]: i= 1 x: [[0, 0, 1]
[0-21 111:948] [INFO] [print]: i= 2 x: [[6, 12, -12]
[0-21 111:948] [INFO] [print]: i= 3 x: [[-6, 12, -12]
[0-21 111:948] [INFO] [print]: i= 4 x: [[-12, -12, 12]
[0-21 111:948] [INFO] [print]: i= 5 x: [[18, -12, 12]
[0-21 111:948] [INFO] [print]: i= 6 x: [[18, -36, 12]
[0-21 111:948] [INFO] [print]: i= 7 x: [[-20, -36, 12]
[0-21 111:948] [INFO] [print]: i= 8 x: [[-12, -36, 12]
[0-21 111:948] [INFO] [print]: i= 9 x: [[66, -60, 12]
[0-21 111:948] [INFO] [print]: i= 10 x: [[66, 132, -12]
[0-21 111:948] [INFO] [print]: i= 11 x: [[0, 0, 1]
[0-21 111:948] [INFO] [print]: i= 12 x: [[6, 12, -12]
[0-21 111:948] [INFO] [print]: i= 13 x: [[18, -36, 12]
[0-21 111:948] [INFO] [print]: i= 14 x: [[-6, 12, -12]
[0-21 111:948] [INFO] [print]: i= 15 x: [[18, -12, 12]
[0-21 111:948] [INFO] [print]: i= 16 x: [[18, -36, 12]
[0-21 111:948] [INFO] [print]: i= 17 x: [[-12, -252, 12]
[0-21 111:948] [INFO] [print]: i= 18 x: [[258, 516, 12]
[0-21 111:948] [INFO] [print]: i= 19 x: [[1026, 2052, 12]
[0-21 111:948] [INFO] [print]: i= 20 x: [[-2046, -4092, 12]

Out[46]: ([array([-2046., -4092.]),
          [-4092.], 0., 0.,
          [-6., -12., 12.],
          [-18., 36.], 36.],
          [-36., -12., 12.],
          [-66., 132.], 132.],
          [-126., -252.], 252.],
          [-258., 516.], 516.],
          [-1026., 2052.], 2052.],
          [-2046., -4092.]))
```

## Ejercicio 1

Grafique la trayectorio de los siguientes sistemas de ecuaciones

$$X_1 + X_2 = 7$$

$$-2X_1 + 5X_2 = 0$$

$$X_0 = (0, 0)$$

$$X_0 = (5, 2)$$

```
In [47]: A = np.array([[1,1], [-2,5]])
b = np.array([7,0])
n = 2
gauss_seidel(AxA, bxb, x=0) * n, tol=1e-5, max_iter=10, return_traj=True # type: ignore
```

```
[0-21 111:951] [INFO] [print]: i= 0 x: [[0, 0, 1]
[0-21 111:951] [INFO] [print]: i= 1 x: [[7, 2, 81]
[0-21 111:951] [INFO] [print]: i= 2 x: [[4,2, 1,681]
[0-21 111:951] [INFO] [print]: i= 3 x: [[15,32, 2,1281]
[0-21 111:951] [INFO] [print]: i= 4 x: [[4,872, 1,94881]
[0-21 111:951] [INFO] [print]: i= 5 x: [[15,0512, 2,024981]
[0-21 111:951] [INFO] [print]: i= 6 x: [[14,9795, 1,991081]
[0-21 111:951] [INFO] [print]: i= 7 x: [[15,008192, 2,00327481]
[0-21 111:951] [INFO] [print]: i= 8 x: [[15,008192, 2,00327481]
[0-21 111:951] [INFO] [print]: i= 9 x: [[15,00131072, 2,000524291]
[0-21 111:951] [INFO] [print]: i= 10 x: [[14,99947571, 1,999979028]
```

```
Out[47]: ([array([1, 999979028]),
```

```
          array([1, 999979028]),
          [0, 0, 1],
          [7, 2, 81],
          [4,2, 1,681],
          [15,32, 2,1281],
          [4,872, 1,94881],
          [15,0512, 2,024981],
          [14,9795, 1,991081],
          [15,008192, 2,00327481],
          [15,008192, 2,00327481],
          [15,00131072, 2,000524291],
          [14,99947571, 1,999979028]))
```

```
In [48]: import numpy as np
import matplotlib.pyplot as plt
```

```
# Sistema
A = np.array([[1, 1], [-2, 5]], dtype=float)
n = 2
```

```
# Punto inicial
x0 = np.array([0, 0], dtype=float)
```

```
# Ejecutar la trayectoria de Gauss-Seidel
sol, traj = gauss_seidel(
    AxA,
    bxb,
    x=x0,
    tol=1e-5,
    max_iter=20,
    return_traj=True
)
```

```
# Puntos de la trayectoria
px = []
py = []
```

```
for k in range(len(traj)) - 1:
    x_kprev = traj[k]
    x_knext = traj[k + 1]
```

```
# Paso 1: actualizar x1 (horizontal)
px.append(x_kprev[0])
py.append(x_kprev[1])
```

```
px.append(x_knext[0])
py.append(x_knext[1])
```

```
# Paso 2: actualizar x2 (vertical)
px.append(x_kprev[0])
py.append(x_knext[0])
```

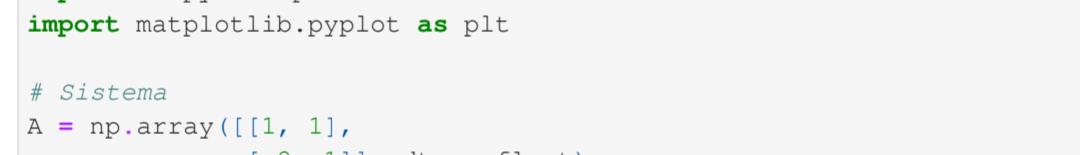
```
# Grafica de la trayectoria
plt.figure()
plt.plot(px, py, '-o', color='green')
plt.xlabel('*x1*')
plt.ylabel('*x2*')
plt.title('Trayectoria con el Metodo de Gauss-Seidel')
plt.grid(True)
plt.axis('equal')
plt.show()
```

```
[0-21 111:951] [INFO] [print]: i= 0 x: [[0, 0, 1]
[0-21 111:951] [INFO] [print]: i= 1 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 2 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 3 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 4 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 5 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 6 x: [[-10185, 98712.5, 100400, -96043.75]]
```

```
[0-21 111:951] [INFO] [print]: i= 7 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 8 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 9 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 10 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 11 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 12 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 13 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 14 x: [[-10185, 98712.5, 100400, -96043.75]]
```

```
[0-21 111:951] [INFO] [print]: i= 15 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 16 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 17 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 18 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 19 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 20 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 21 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 22 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 23 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 24 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 25 x: [[-1, 1, -1, 2]]
```

```
trayectoria con el Metodo de Gauss-Seidel
```



## Ejercicio 2

$$X_1 + X_2 = 6$$

$$-2X_1 + X_2 = 0$$

$$X_0 = (6, 0)$$

$$X_0 = (3, 3)$$

```
In [49]: A = np.array([[1,1], [-2,1]])
b = np.array([6,0])
n = 2
gauss_seidel(AxA, bxb, x=0) * n, tol=1e-5, max_iter=10, return_traj=True # type: ignore
```

```
[0-21 111:951] [INFO] [print]: i= 0 x: [[0, 0, 1]
[0-21 111:951] [INFO] [print]: i= 1 x: [[6, 0, 1]
[0-21 111:951] [INFO] [print]: i= 2 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 3 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 4 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 5 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 6 x: [[-1120, 7910, 4681, -7695.]
[0-21 111:951] [INFO] [print]: i= 7 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 8 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 9 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 10 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 11 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 12 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 13 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 14 x: [[-1120, 7910, 4681, -7695.]
[0-21 111:951] [INFO] [print]: i= 15 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 16 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 17 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 18 x: [[1, 1, -1, 3]]
[0-21 111:951] [INFO] [print]: i= 19 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 20 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 21 x: [[1, 0, 3, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 22 x: [[-1, 1, -1, 2]]
[0-21 111:951] [INFO] [print]: i= 23 x: [[1360, 2490, 1120, -1350.]
[0-21 111:951] [INFO] [print]: i= 24 x: [[1, -1, 2, 0]]
[0-21 111:951] [INFO] [print]: i= 25 x: [[1360, 2490, 1120, -1350.]]
```

```
Out[49]: ([array([1, 999979028]),
```

```
          array([1, 999979028]),
          [0, 0, 1],
          [6, 0, 1],
          [1, -1, 2, 0],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],
          [-1120, 7910, 4681, -7695.],
          [1360, 2490, 1120, -1350.],
          [1, -1, 2, 0],
          [1360, 2490, 1120, -1350.],
          [1, 1, -1, 3],
          [-1, 1, -1, 2],
          [1360, 2490, 1120, -1350.],
          [1, 0, 3, -1, 2],

```

