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import matplotlib.pyplot as plt

import numpy as np

N = 1000

x = np.linspace(0,1,N+1) #no of points required to have n steps size.

dx = x[1]-x[0] #step size

#matrix form of differentail equation

main\_diag = -2\*np.ones(N-1)

off\_diag = np.ones(N-2)

derivative\_matrix = (np.diag(main\_diag) + np.diag(off\_diag, k=1)+ np.diag(off\_diag, k=-1))/dx\*\*2

x2\_matrix = np.diag((10\*x[1:-1])\*\*2)

LHS\_matrix = derivative\_matrix #+ x2\_matrix

w, v = np.linalg.eigh(LHS\_matrix)

print(' 1st eigenvalue',w[-1])

plt.plot(-1\*v[:,-1],label='1-eigenvector')

plt.plot(-1\*v[:,-2],label='2-eigenvector')

plt.plot(-1\*v[:,-3],label='3-eigenvector')

plt.plot(-1\*v[:,-4],label='4-eigenvector')

plt.axhline(y = 0, color = 'black', linestyle = '-')

plt.legend()

plt.show()

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