Digital Filter

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Contents

***Abstract*—This manual provides a simple introduction to the digital filter.**

1 Difference Equation

1. Let
$$x(n) = \left\{1, 2, \underset{\uparrow}{3}, 4, 2, 1\right\} \tag{0.1}$$
Sketch $x(n)$.
2. Let
$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2), \quad y(n) = 0, n < 0 \tag{0.2}$$
Sketch $y(n)$.

Solution: The following code yields Fig. 2.

```
import numpy as np
import matplotlib.pyplot as plt
#If using termux
import subprocess
import shlex

n=np.linspace(-2,3,6)
x=np.array([1.0,2.0,3.0,4.0,2.0,1.0,0,0])
k = 20
y = np.zeros(20)
y[0] = x[0]
y[1] = -0.5*y[0]+x[1]

for n in range(2,k-1):
        if n < 8:
                y[n] = -0.5*y[n-1]+x[n]+x[n
                    -2]
        else:
                y[n] = -0.5*y[n-1]

#subplots
plt.subplot(2, 1, 1)
plt.stem(range(0,8),x)
plt.title('Digital Filter Input-Output')
plt.ylabel('$x(n)$')
plt.grid()# minor


plt.subplot(2, 1, 2)
plt.stem(range(0,k),y)
plt.xlabel('$n$')
plt.ylabel('$y(n)$')
plt.grid()# minor

#If using termux
plt.savefig('../figs/xnyn.pdf')
plt.savefig('../figs/xnyn.eps')
subprocess.run(shlex.split("termux-open ../figs/
    xnyn.pdf"))
#else
plt.show()
```

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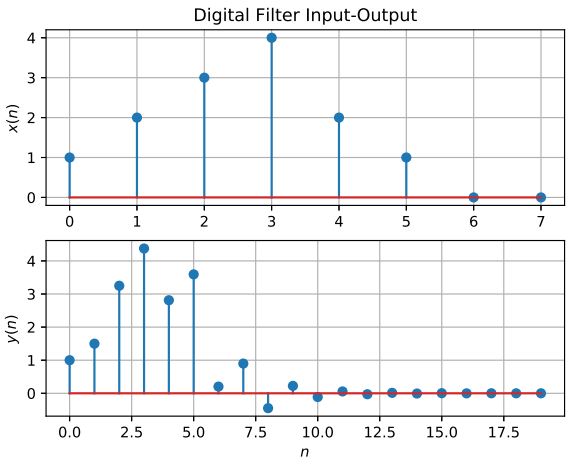

Fig. 2