REPORT

Zajęcia: Analog and digital electronic circuits
Teacher: prof. dr hab. Vasyl Martsenyuk

Lab 10
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Topic: "Non-recursive Filters Design"
Variant 2

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1. Problem statement: The objective is to design non-recursive filters using window technique

2. Input data:
N = 30
Ωc = π/3

3. Commands used (or GUI):

a) source code

Importing libraries

```
import numpy as np
import matplotlib.pyplot as plt
import scipy.signal as sig
```

Computing signals

```
N = 30  # length of filter
Omc = np.pi/3

# compute impulse response
k = np.arange(N)
hd = Omc/np.pi * np.sinc(k*Omc/np.pi)
# windowing
w = np.ones(N)
h = hd * w

# frequency response
Om, H = sig.freqz(h)
```

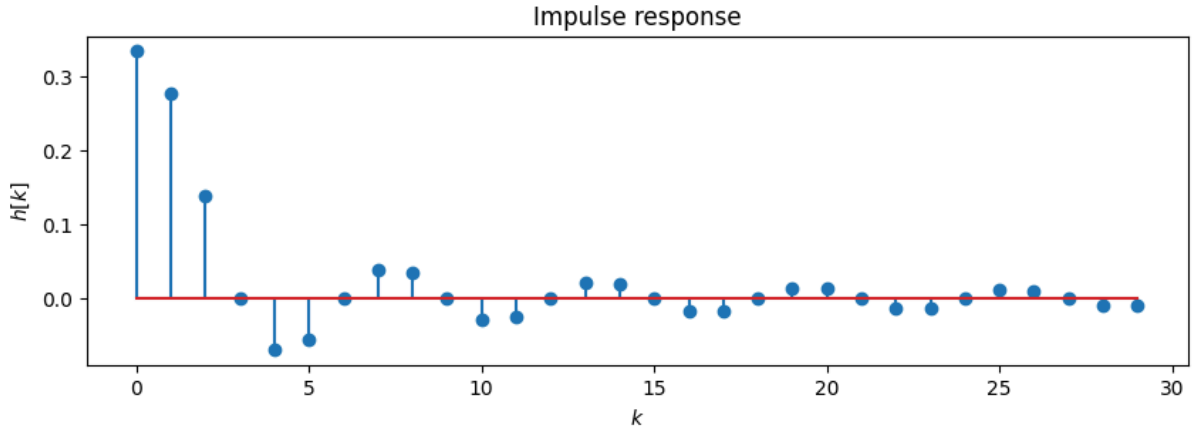
Plotting computed response, magnitude and phase

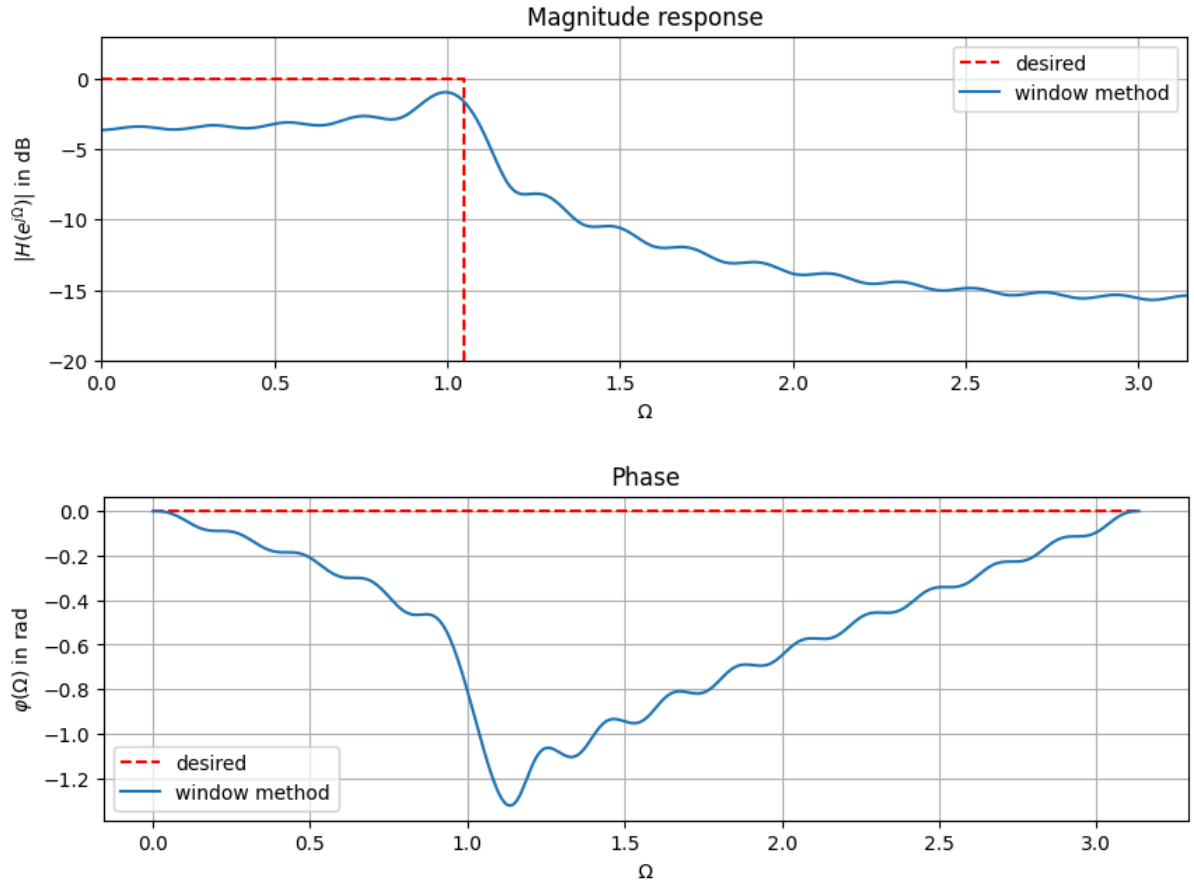
```
# plot impulse response
plt.figure(figsize=(10, 3))
plt.stem(h )
```

```
plt.title('Impulse response')
plt.xlabel(r'$k$')
plt.ylabel(r'$h[k]$')
# plot magnitude responses
plt.figure(figsize=(10, 3))
plt.plot([0, Omc, Omc], [0, 0, -100], 'r--', label='desired')
plt.plot(Om, 20 * np.log10(abs(H)), label='window method')
plt.title('Magnitude response')
plt.xlabel(r'$\Omega$')
plt.ylabel(r'$|H(e^{j \Omega})|$ in dB')
plt.axis([0, np.pi, -20, 3])
plt.grid()
plt.legend()
# plot phase responses
plt.figure(figsize=(10, 3))
plt.plot([0, Om[-1]], [0, 0], 'r--', label='desired')
plt.plot(Om, np.unwrap(np.angle(H)), label='window method')
plt.title('Phase')
plt.xlabel(r'$\Omega$')
plt.ylabel(r'$\varphi (\Omega)$ in rad')
plt.grid()
plt.legend()
```

https://github.com/wm64167/AADEC

4. Outcomes:





5. Conclusions:

This lab explored designing non-recursive filters using the window method. The resulting filter from the rectangular window does not have the desired linear phase response. Increasing the filter length, N, improves the transition width between the passband and stopband but doesn't eliminate the ripple in the passband and stopband. The rectangular window introduces ripple in the passband and stopband of the filter's frequency response. Increasing the window length, N, narrows the main lobe of the frequency response but doesn't affect the ripple level.