WIGGLES

EXPERIMENT #04

SEPTEMBER 2022

EXPERIMENT NAME

Implementing and performing convolution both starting from the same index and different index of two different signals with a user defined function.

1. CONVOLUTION SAME INDEX

Theory

1. **Convolution** is a mathematical tool for **combining two signals** to form a third signal. Therefore, in signals and systems, the convolution is very important because it relates t**he input signal** and **the impulse response** of the system to produce the output signal from the system. In other words, the convolution is used to express the input and output **relationship of an LTI system.**
2. The **continuous case** requires **integrals** to perform the convolution and the formula of the convolution of the continuous case can be denoted by:

Expression

$$y(t) = x(t) * h(t) \equiv \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$$

Getting the environment ready

- **Python 3.10** is installed in the system and added to the system variables.
- The library is installed through pip i.e. through the command **“pip install wiggles.”**
- Here, **vs code** is used to code and test out the results.
- The code is written to best find the solution of the given problem and then is evaluated and displayed using the inbuilt **‘show()’** or the **‘compare()’** function in wiggles.

PROBLEM

- Performing convolution between two signals starting with the same index.

PROGRAM CODE

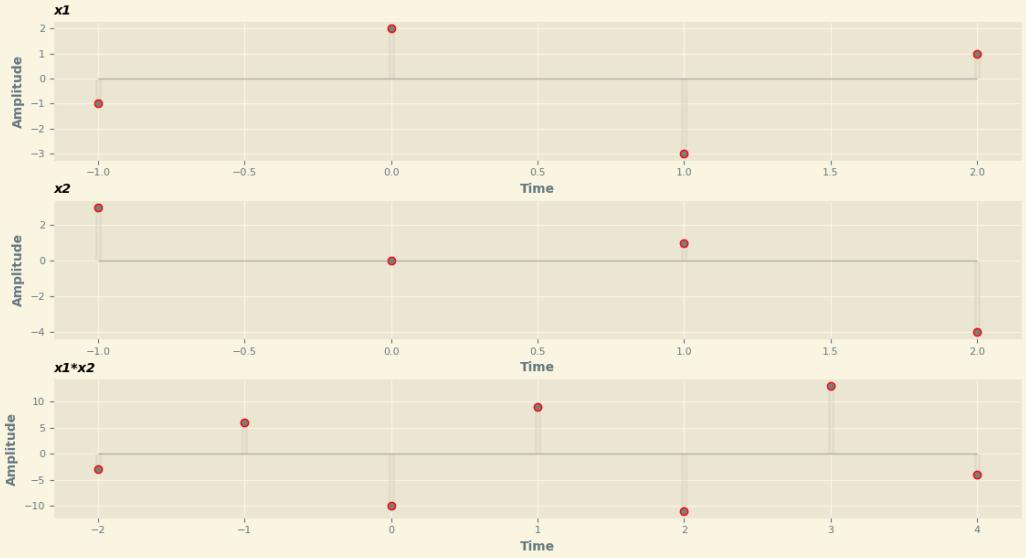
```
#from wiggles import signals as sp

#making two test signals (Starting from the same index)
x1 = sp.discrete([-1,2,-3,1],-1)
x1.name="x1"
x2 = sp.discrete([3,0,1,-4],-1)
x2.name="x2"

#Performing convolution and displaying the result
result = x1.convolve(x2)
x1.compare(x2,result)
```

OUTPUT

Printed notation for the convolution operation

```
x1
[      -1      2       -3      1       ]
               ↑
x2
[      3       0       1       -4      ]
               ↑
x1*x2
[      -3      6       -10     9       -11     13      -4      ]
                       ↑
```

Plotted graph for the convolution operation



The comparison for the convolution operation plotted in the discrete time domain using a user defined function. Represented through a stem graph.

2. CONVOLUTION DIFFERENT INDEX

Theory

1. **Convolution** is a mathematical tool for **combining two signals** to form a third signal. Therefore, in signals and systems, the convolution is very important because it relates t**he input signal** and **the impulse response** of the system to produce the output signal from the system. In other words, the convolution is used to express the input and output **relationship of an LTI system.**
2. The **continuous case** requires **integrals** to perform the convolution and the formula of the convolution of the continuous case can be denoted by:

Expression

$$y(t) = x(t) * h(t) \equiv \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$$

Getting the environment ready

- **Python 3.10** is installed in the system and added to the system variables.
- The library is installed through pip i.e. through the command **“pip install wiggles.”**
- Here, **vs code** is used to code and test out the results.
- The code is written to best find the solution of the given problem and then is evaluated and displayed using the inbuilt **‘show()’** or the **‘compare()’** function in wiggles.

PROBLEM

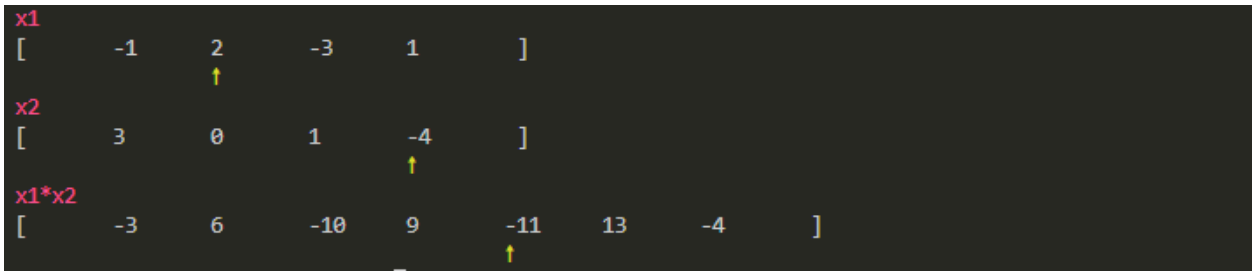
- Performing convolution between two signals starting with a different index.

PROGRAM CODE

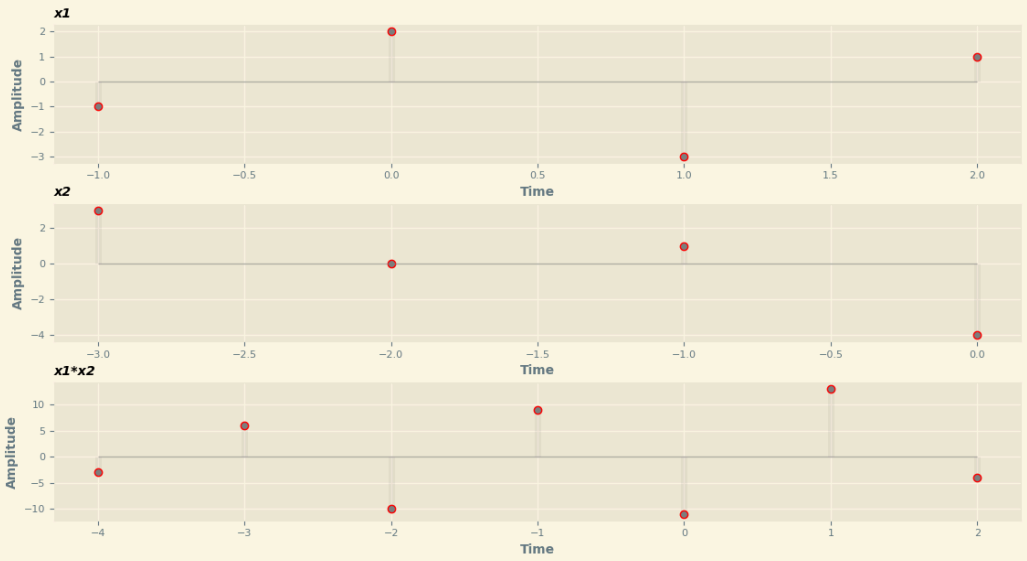
```
#from wiggles import signals as sp

#making two test signals (Starting from different index)
x1 = sp.discrete([-1,2,-3,1],-1)
x1.name="x1"
x2 = sp.discrete([3,0,1,-4],-3)
x2.name="x2"

#Performing convolution and displaying the result
result = x1.convolve(x2)
x1.compare(x2,result)
```

OUTPUT

Printed notation for the convolution operation



Plotted graph for the convolution operation



The comparison for the convolution operation plotted in the discrete time domain using a user defined function. Represented through a stem graph.