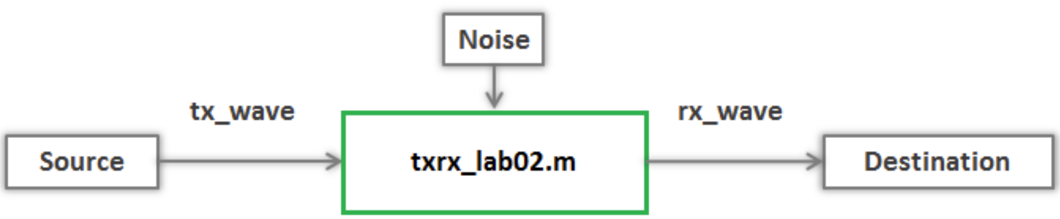
LAB 2 TASK 1 - MODEL THE CHANNEL (1 point possible)

In this task, you will study the effects of the channel, highlighted in green, on the input signal tx_wave by fitting the output signal rx_wave with the exponential model.

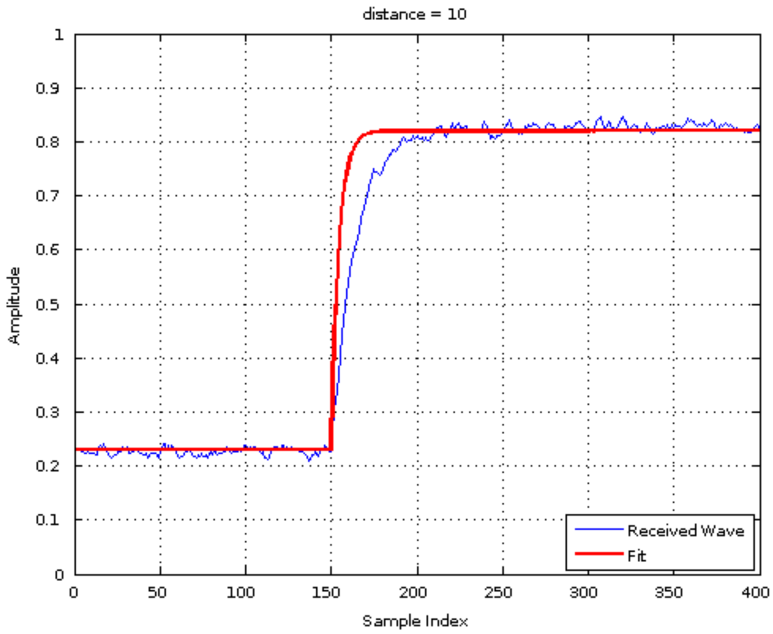


The code window below contains a MATLAB script that sends a waveform similar to the unit step through the channel. Your task is to use the function `fit_rcv` to fit the waveform received at the output of the channel.

```
distance = 10;  % distance from transmitter to receiver
tx_wave = [zeros(1,150) ones(1,250)];   % define step-like waveform

% channel %
rx_wave = txrx_lab02(tx_wave,distance); % transmit waveform through channel

% fit_rcv(rx_wave,c,d,k,a) fits rx_wave by a function of the form
%     y(n) = c + k*(1-a^(n-d)) for n >= d and 0 otherwise.
% modify the values below to find the correct fit
c = 0.23;
d = 150;
k = 0.82 - 0.23;
a = 0.8;

mse = fit_rcv(rx_wave,c,d,k,a);          % fit channel output to model
```

Unanswered

Figure 1



MSE = 0.003928

Run Code

Check Save *You have used 0 of 10 submissions*

INSTRUCTIONS

There are three steps in this task.

<u>Step 1: Run the code with the given bit sequence to observe the step response.</u>

Let's first look at how the step response is generated by the code. The first line **`distance=value`** defines the transmission distance in units of centimeters. The second line of the code defines a vector **tx_wave** that is simliar to a unit setp. The function **`txrx_lab02`** simulates the effect of the channel on the transmitted waveform. The function **`fit_rcv(rx_wave,c,d,k,a)`** will fit the received waveform `rx_wave` with the following mathematical model

$$y = c + k * (1 - a^{n-d+1})u(n-d)$$

where the four parameters represent four channel effects as follows

$c =$ offset signal

$d =$ time offset

$k =$ signal range

$a =$ exponential response.

The MATLAB output will return a figure containing a plot comparing the **received** waveform `rx_wave` with the one fitted by the model with the preselected parameters. The function **fit_rcv** will also return a value **MSE** (mean squared error) that measures the difference between the received and the fitted waveform.

Step 2: Fit the channel response by adjusting the four parameters.

Now, it's your turn to adjust the four parameters (c, d, k, a) to fit the received waveform until the **MSE** value returned by the MATLAB code is less than a preselected threshold 1×10^{-4}. You may want to take note of the final values of the four parameters (c, d, k, a) since you will use them again in the next lab task.

Help

Step 3: Submit your work

You can try to run your code as many times as you like to fit the step response. Once you obtain the desired **MSE**, remember to click on the **Check** button to submit your work.