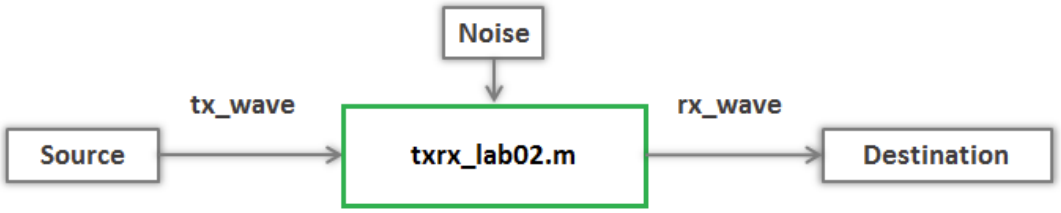
LAB 2 TASK 1 - MODEL THE CHANNEL (1/1 point)

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.

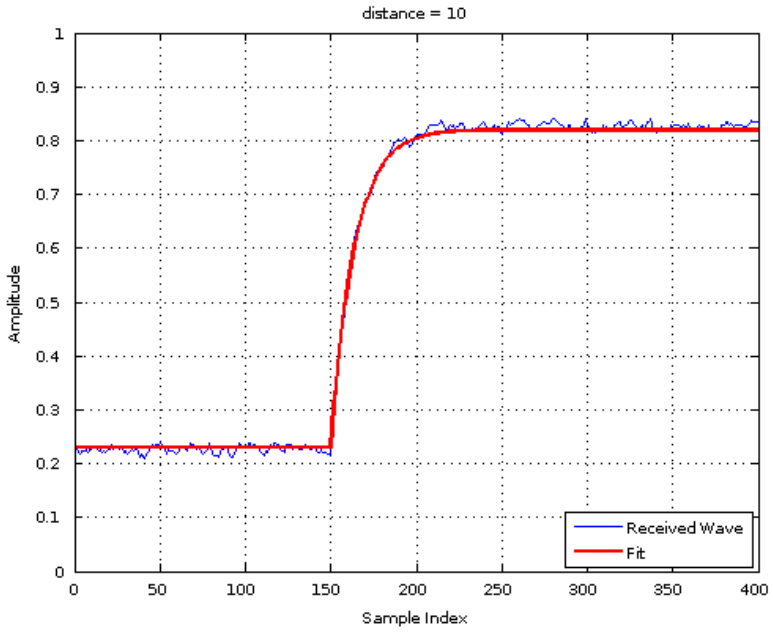
```
distance = 10;  % distance from transmitter to receiver
tx_wave = [zeros(1,150) ones(1,250)];   % define step-like waveform

% 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 = 0.93;

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

Correct

```
c = 0.23;
d = 150;
k = 0.6;
a = 0.93;
```

Help

Figure 1



MSE = 7.173e-05

Check | Reset | Save | Hide Answer | *You have used 1 of 10 submissions*

INSTRUCTIONS

There are three steps in this task.

Step 1: Run the code with the given bit sequence to observe the step response.

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.

Help

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.

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.