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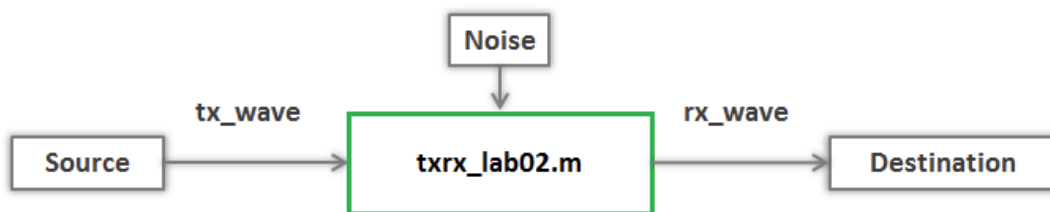
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## LAB 2 TASK 1 - MODEL THE CHANNEL (1 point possible)

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.

```

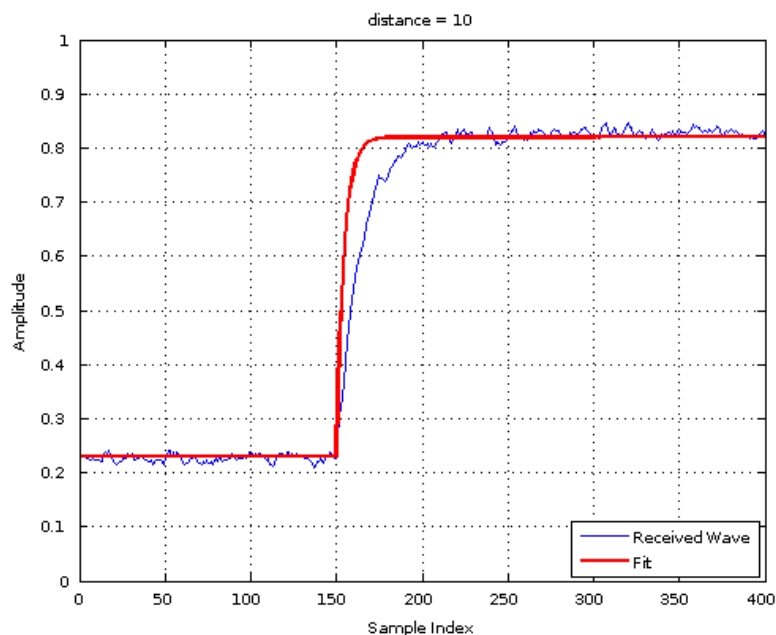
1 distance = 10; % distance from transmitter to receiver
2 tx_wave = [zeros(1,150) ones(1,250)]; % define step-like waveform
3
4 % channel %
5 rx_wave = txrx_lab02(tx_wave,distance); % transmit waveform through channel
6
7 % fit_rcv(rx_wave,c,d,k,a) fits rx_wave by a function of the form
8 % y(n) = c + k*(1-a^(n-d)) for n >= d and 0 otherwise.
9 % modify the values below to find the correct fit
10 c = 0.23;
11 d = 150;
12 k = 0.82 - 0.23;
13 a = 0.8;
14
15 mse = fit_rcv(rx_wave,c,d,k,a); % fit channel output to model
  
```

Unanswered

Figure 1

1 of 3

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MSE = 0.003928

Run Code

Check

Save

You have used 0 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 similar to a unit step. 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  $1 \times 10^{-4}$ . 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.



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