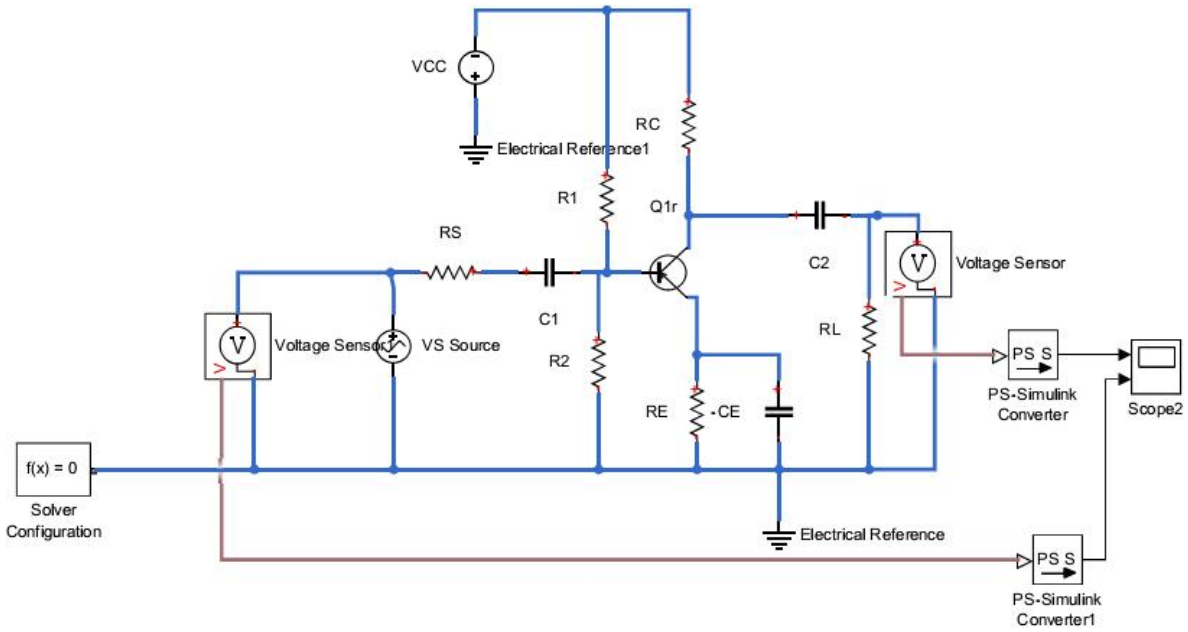
Exp 12B: Common-Emitter BJT amplifier in Simulink



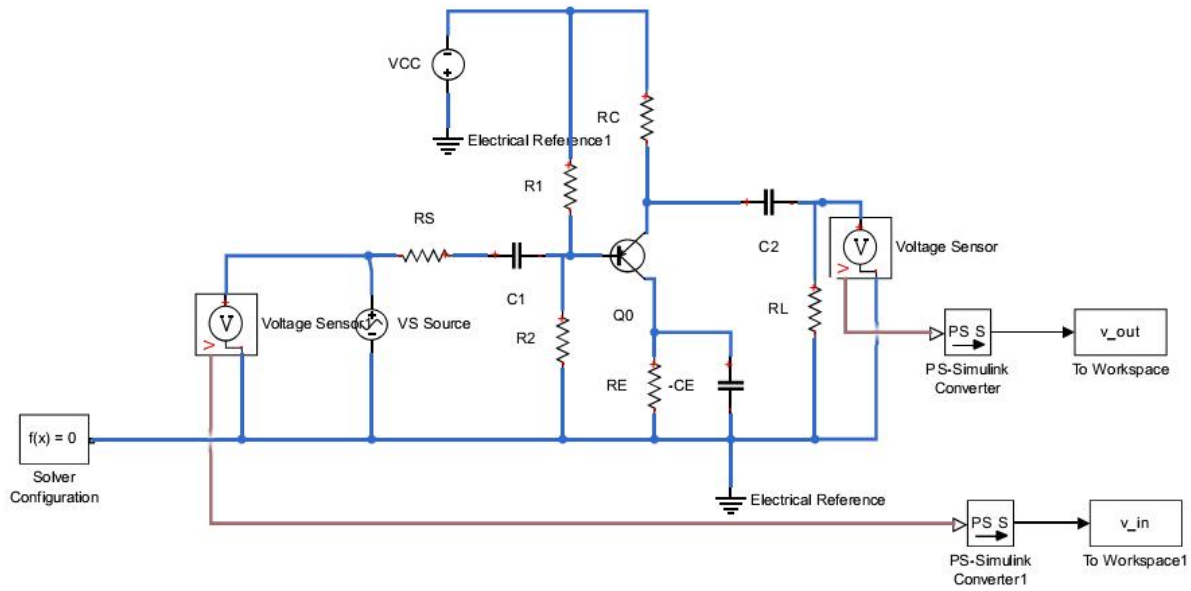
Step 1: Create the Simulink model above with circuit component values as below:
RS = 500 OHM
R1= 47K, R2=5K,
RC=10K, RE=2K, RL=20K
C1=CS=CE=10 µF
Transistor Beta =50
VS= 10mV, I KHz ; VCC=15V

Step 2: Connect the scope. Change the Number of Axes to 2
Point click on the scope and then click on the top right little gear icon.

Step3: Simulate for 5 cycles and view the input output waveform.

Step 4: Calculate the Gain of the Amplifier.
Observe peaks from 2nd cycle onwards. Report the positive and negative peaks

Exp 12C: Common-Emitter BJT amplifier in Simulink (Partial Model Sweeping)



Step 1: Remove the scope and replace them by **To Workspace** blocks

It is available under **Simulink>Sinks**

Take TWO Numbers of them

Name them as **v_out and v_in**

Step 2: Double click on RC, Change its value to **rc_x.**

This variable is called Sweep Variable, which may be changed while in simulation to understand it's impact on the circuit.

Step 3: Study the Code below :

A. Load the model

```
load_system('exp12_C.slx');
```

B. Set model parameters

```
set_param('exp12_C/RC', 'R', 'rc_x');
```

C. Simulate the model

```
sim('exp12_C');
```

D. Log the results into a variable

```
y(:,rc_x)=v_out.signals.values(:,1);
```

E. Iterate over the Sweep variable

```
for rc_x = 1:5
  ------
  -----
end
```

F. Display Results

Code:

```
%% Download the 'exp12_C.slx' and 'topcode.m' in the SAME DIRECTORY
%% Reset old simulation results from workspace
clc; clear all; close all;
%% Design Exploration Section
for rc_x = 1:5 % Sweep resistance from 1K to 5K
    % Load the simulink model into memory
    load_system('exp12_C.slx');
    % Setting parameter value to resistance RC used in the design
'exp12_C.slx'
    % 'R' is the block paramaeter for resistance.
    % 'rc_x' is the sweep variable.
    set_param('exp12_C/RC', 'R', 'rc_x');

    % Similarly we can set values for transistor beta.
    % 'beta' is the sweep variable.
    % 'hfe' is the block paramaeter for transistor Q0 present in the model
'exp12_C.slx'
    % Uncomment the line below if you want to sweep beta as well.
    % Before uncommenting declare a loop variable 'beta', similar to 'rc_x'
    % This will be a nested for loop now. Hence you need to handle
    % multidimensional arrays.
%     set_param('exp12_C/Q0', 'hfe', 'beta');

    sim('exp12_C');
    y(:,rc_x)=v_out.signals.values(:,1);
end

%% Display Results
% Exclude the first row of data points due to solver comfiguration.
% Solver starts simulation from a steady state :(
in=v_in.signals.values(2:1001); % this is tyical way to traverse  through a
nested simulation structure
out=y(2:1001,:); % storing output y into out for our readability purpose.
plot(tout,out(:,1),tout,out(:,2),tout,out(:,3),tout,out(:,4),tout,out(:,5));
%% Compute Gain
for rc_x = 1:5
    Av(:,rc_x)=max(out(:,rc_x))./max(in);
end
Av_max=max(Av);
sprintf('The Gain of the Amplifier is %.2f', Av_max)
```