Matlab and Parameter Optimization:

You should develop equations that relate your design parameters to the error criteria. If you can solve for the parameters directly from the equation, you are finished - you have the optimal performance for the circuit you proposed. Unfortunately in many cases, the large number of parameters or the nonlinear relationship between them , makes this solution very difficult or impossible.

The performance equations, however, can be examined though a program such as Matlab, and optimization can be done though a creative strategy for iterating though the critical performance parameters until the error is at a practical minimum.

Matlab functions: Available Matlab functions can be combined together in a program to create a custom function.

Example: Create a Matlab function that will evaluate points of a transfer function of a first-order low-pass filter given an array for the frequency axis points (in Hz), the cutoff frequency (in Hz), and the gain at DC (in dB).

1) Use a text editor to create a file lpf1.m (functions in Matlab always end in .m).
2) Then enter the following text.

```
function h = lpf1(f,fc,gdb)
%   This function evaluates complex points of a first
%   order low-pass filter with cut-off frequency fc
%   in Hertz, and a gain in dB at DC of gdb.  The
%   function syntax is:
%
%          tflp = lpf1(f, fc, gdb)
%
%   where f is an array of points in Hertz where the
%   function is eavluated at, and tfpl is the array of
%   complex evaluation points.
%
j = sqrt(-1);
p = j*2*pi*f;
gdc = 10^(gdb/20);
h = gdc./(p/(2*pi*fc) + 1 );
```

3) Save the file in your "working directory" and execute in Matlab just like any other function. If you type *help lpf1* in Matlab, the first sequence of comments will print to the screen.

4) All variables defined inside the function will be undefined when the function is through (local variables).

Create an analogous function for a high-pass filter:
1) Create file with a text editor called hpf1.m and enter:

```
function h = hpf1(f,fc,gdb)

%   This function evaluates complex points of a first
%   order high-pass filter with cut-off frequency fc
%   in Hertz, and a gain in dB at infinity of gdb.
%   The function syntax is:
%
%          tfhp = hpf1(f, fc, gdb)
%
%   where f is an array of points in Hertz where the
%   function is evaluated at, and tfhp is the array of
%   complex evaluation points.
%
j = sqrt(-1);
p = j*2*pi*f;
ginf=10^(gdb/20);
h = ginf*(p/(2*pi*fc))./(p/(2*pi*fc) + 1 );
```

Matlab Scripts: Matlab functions can be combined together to create a series of commands to be executed.