

Lab#4 – Control Flow in MATLAB

MATLAB is also a programming language. Like other computer programming languages, MATLAB has some decision-making structures for control of command execution. These decisions making or control flow structures include for loops, while loops, and if-else-end constructions.

1. CONTROL FLOW

MATLAB has basically three control flow structures:

(1) if statement (2) for loop (3) while loop

1.a) THE “if end” STRUCTURE

There are 3 ways to write “if end” structure.

“if end” structure type	Sample MATLAB code
if EXPRESSION STATEMENTS end	<pre>A=10; B=20; C=A-B; if A<B % A<B is expression here disp('C is a positive number') % It's the statement here end</pre>
if EXPRESSION STATEMENTS else STATEMENTS end	<pre>A=10; B=5; C=A-B; if A<B % A<B is expression here disp('C is a positive number') % It's the statement here else disp('C is a negative number') % It's the statement here end</pre>
if EXPRESSION STATEMENTS elseif EXPRESSION STATEMENTS else STATEMENTS end N.B: You can write multiple elseif here with proper expression.	<pre>A=10; B=10; C=A-B; if A<B % A<B is expression here disp('C is a positive number') % It's the statement here elseif A>B % A>B is expression here disp('C is a negative number') % It's the statement here else disp('C could be Zero') % It's the statement here end</pre>

PRACTICE 1: Write a MATLAB code using “if end” structure to display what kind of root we can get from $ax^2 + bx + c = 0$ based on the random input values of $a, b, & c$

Tips: We all know solution for $ax^2 + bx + c = 0$ is $x = \frac{-b \pm \sqrt{b^2 - 4 \times a \times c}}{2a}$. However, what kind of

roots we are getting it's totally depends on $\sqrt{b^2 - 4 \times a \times c}$ this part. Based on the value of $\sqrt{b^2 - 4 \times a \times c}$ we can get three kinds of roots:

- i) $b^2 - 4 \times a \times c > 0$, there are multiple real roots
- ii) $b^2 - 4 \times a \times c < 0$, there are multiple imaginary roots
- iii) $b^2 - 4 \times a \times c = 0$, there is a single real root.

1.b) THE “for” LOOP STRUCTURE

“for” Loop structure type	Sample MATLAB codes
<pre>for VARIABLE=XPRESSION STATEMENTS end</pre>	<p>I want to perform the summation: $A=1+2+3+\dots\dots\dots+50$</p> <pre>A=0; % 1st I assigned that I do not have any value in my sumation variable. for i=1:1:50 % Variable=Expression. Here, i=variable, 1:1:50=expression A=A+i; % statement end</pre>
<p>N.B: You can write multiple for loops here with proper expression.</p> <p>For Example:</p> <pre>for VARIABLE=XPRESSION for VARIABLE=XPRESSION STATEMENTS end end</pre>	<p>Now, I want to perform the summation: $A = 1(1^2 + 2^2) + 2(1^2 + 2^2) + 3(1^2 + 2^2) + \dots\dots\dots + 50(1^2 + 2^2)$</p> <pre>A=0; for i=1:1:50 % Variable=Expression. Here, i=variable, 1:1:50=expression B=0; for j=1:1:2 % Variable=Expression. Here, i=variable, 1:1:50=expression B=B+j*j % statement for the 2nd loop end A=A+(i*B); % statement for the 1st loop end</pre>

PRACTICE 2: Write a MATLAB code using “for” loop structure to perform the summation $A = 1(1 \times 2 \times 3) + 2(2 \times 3 \times 4) + 3(3 \times 4 \times 5) + \dots\dots\dots + 10(10 \times 11 \times 12)$

1.c) THE “while.....end” LOOP STRUCTURE

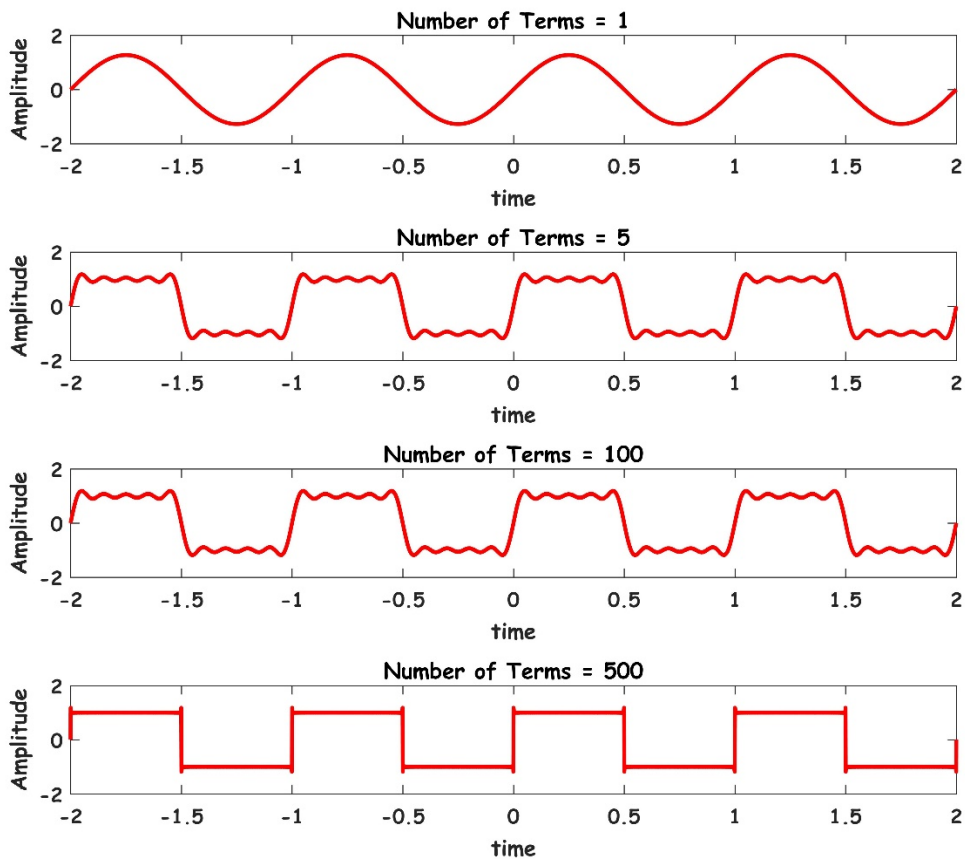
“while end” structure type	Sample MATLAB code
while EXPRESSION STATEMENTS end	A=2; while A<=10 % A<=10 is expression here A=3*A % It's the statement here end

LAB ASSIGNMENT

1. Perform the following summation using the “for” loop structure:

$$seriesum = \frac{4A}{\pi} \sum_{n=odd} \frac{1}{n} \sin(2\pi nt)$$

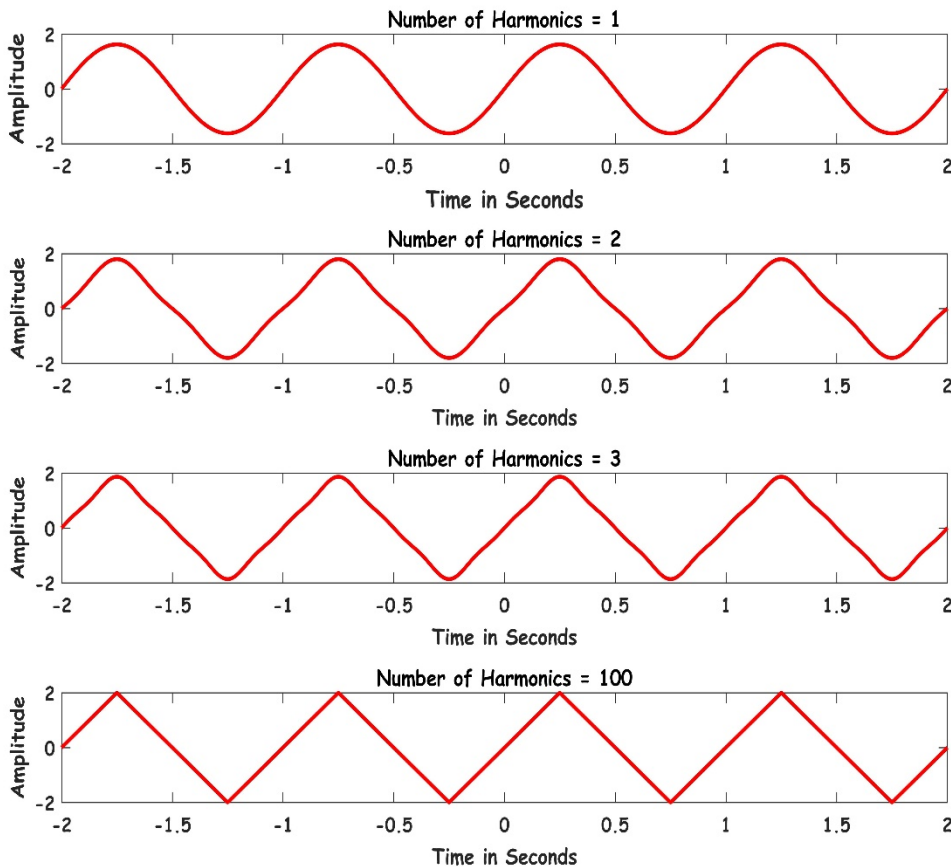
Perform the summation for four (04) different values of $n = 1, 5, 100, 500$ and plot all those results in a single graph window using subplot command. The result should look like as follows:



2. Perform the following summation using the "for" loop structure:

$$seriesum = \frac{8A}{\pi^2} \sum_{n=odd} (-1)^{\frac{n-1}{2}} \times \frac{1}{n^2} \sin(2\pi nt)$$

Perform the summation for four (04) different values of $n = 1, 2, 3, 100$ and plot all those results in a single graph window using subplot command. The result should look like as follows:



Questions for Lab Assignment 1 & 2:

1. When you take a look at the equation, what kind of graph you expect when you only have 1 or 2 summation terms?

2. When you are adding more and more terms, the plot is changing its shape from the plot that was plotted using only one terms. Do you have any explanation for this deviation?

[N.B: I am not expecting a perfect answer for this. Your answer does not have to be perfect. I am just curious to know the reasoning behind your explanation. Marks will be given based on that, not for the perfect answer.]

3. I have a Row matrix, $X = [1 \ 2 \ 3 \ 4]$ and a Column matrix, $h = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$. Now perform dot

multiplication between those two, $Y = X .* h$. The result will be something like this:

$$Y = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \\ 4 & 8 & 12 & 16 \end{bmatrix}$$

Now you have to write a code to sum the elements of each row. The result will be something like as follows:

10 20 30 40

Tips: Use for loop to perform this.

4. In Lab assignments 1 & 2, we are changing the values of n. What does this "n" represents for that signal. Also, when you are adding multiple n, what does that mean, i.e. what you are actually adding?