



Recitation Class 02 for VG101

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Interface

- Please follow the TA's demonstration, if you bring a laptop with you to the class!
- Desktop / Desktop Layout / Default
- Command Window
- Workspace
- Command History
- Current Folder

Editor

- Create a new script
- Type the code in it
- Save and run
- Debug (maybe covered in the future)
- The rules of naming in VG101
 - s5123709xxx_hwk1.m
 - 5123709xxx_hwk1.m
 - s5123709xxx_hwk.m
 - s5123709xxx _ hwk1.m
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Variables

- Scalar
 - E.g. $a = 3;$ $b = 1.2345;$
- Vector
 - E.g. $v = [1,2,3,4];$ $v = [1\ 2\ 3\ 4];$
 $v = 1:1:4;$ $v = 1:4;$
- Matrix
 - E.g. $c = [1,2,3;4,5,6];$ $c = [1\ 2\ 3;4\ 5\ 6];$

Operators

- Plus: +
- Minus: -
- Multiply: *
- Divide: /
- Power: ^
- Assign: =
- Brackets: ()

Operators

- Interesting usage of “.”
- For “*”: #(column of left matrix) = #(row of right matrix)
- For “.*”: the same size for both matrix

The same rule for “./” and “.^”

- Comparison of their usage:
 - E.g. find the value of $a_i = \frac{\sin(i)}{i}$ for all $0 < i \leq 100, i \in \mathbb{N}$
 - E.g. Information Search Online (Beyond this course)

Operators

- Suppose you have a database including the name of the following books:
 - *Introduction to Computer*
 - *Introduction to Programming*
 - *Computer Programming*
 - *Introduction to MATLAB Programming*
 - *MATLAB and Programming*
 - *Mathematics and Programming*
 - *Mathematics and MATLAB Programming*
- You search “MATLAB programming”
- Larry Page and Google PageRank algorithm

Some other points

- Comments: %
- Separate the commands: ,
- Suppress the output: ;
- Have a try:
 - `a = 3, b = 5;`
 - `a = 3, b = 5`
 - `a = 3; b = 5;`
 - `a = 3; b = 5`

Constants in MATLAB

- Never name your variables as:
- $\pi = 3.14159265358\dots$
- $i = \sqrt{-1}$
- Inf = Infinity
- NaN = Not a number
- ...e... = 10 to the power of ...
 - E.g. format long;
123 * pi

Built-in Functions in MATLAB

- `help`
 - E.g. `help format`;
 - `format longeng`;
`pi * 123`
`format longe`;
`pi * 123`
 - `format`;
`pi * 123`
- `clc`
- `clear`
 - If you want to find more, try “`help clear`”.

Built-in Functions in MATLAB

- `round` `a = [round(-5.556) round(-5.446)]`
 - Compare it with “`a = [fix(-5.556) fix(-5.446)]`”
 - Compare it with “`a = [floor(-5.556) ceil(-5.446)]`”
 - Compare it with “`a = [ceil(-5.556) floor(-5.446)]`”
- `log` `a = log(exp(5))`
 - Compare it with “`a = log10(10 ^ 5)`”
- `mod` `a = mod(-3,2)`
 - Compare it with “`a = rem(-3,2)`”
- `sin` `a = sin(pi / 4)`
 - Compare it with “`a = sind(45)`”
- `linspace` `a = linspace(1,20,4)`
 - Compare it with “`a = 1:(20 - 1) / 3:20`”

Built-in Functions in MATLAB

- `sqrt` `a = sqrt(81)`
- `abs` `a = abs(-81)`
- `sum` `sum([8 2 5 4])`
 - How to express “dot product” with the function?
- `size` `a = size([8 2 5 5; 6 3 9 2; 7 1 1 4])`
 - Have a try: `a = size(size([8 2 5 5; 6 3 9 2; 7 1 1 4]))`
 - Do you know the reason?
- `zeros` `a = zeros(3)`
 - Compare it with “`a = ones(3)`”
- `min` `a = min([8 2 5; 6 3 9; 7 1 4])`
 - Have a try: `a = max(min ([8 2 5; 6 3 9; 7 1 4]))`
 - Do you know the reason?

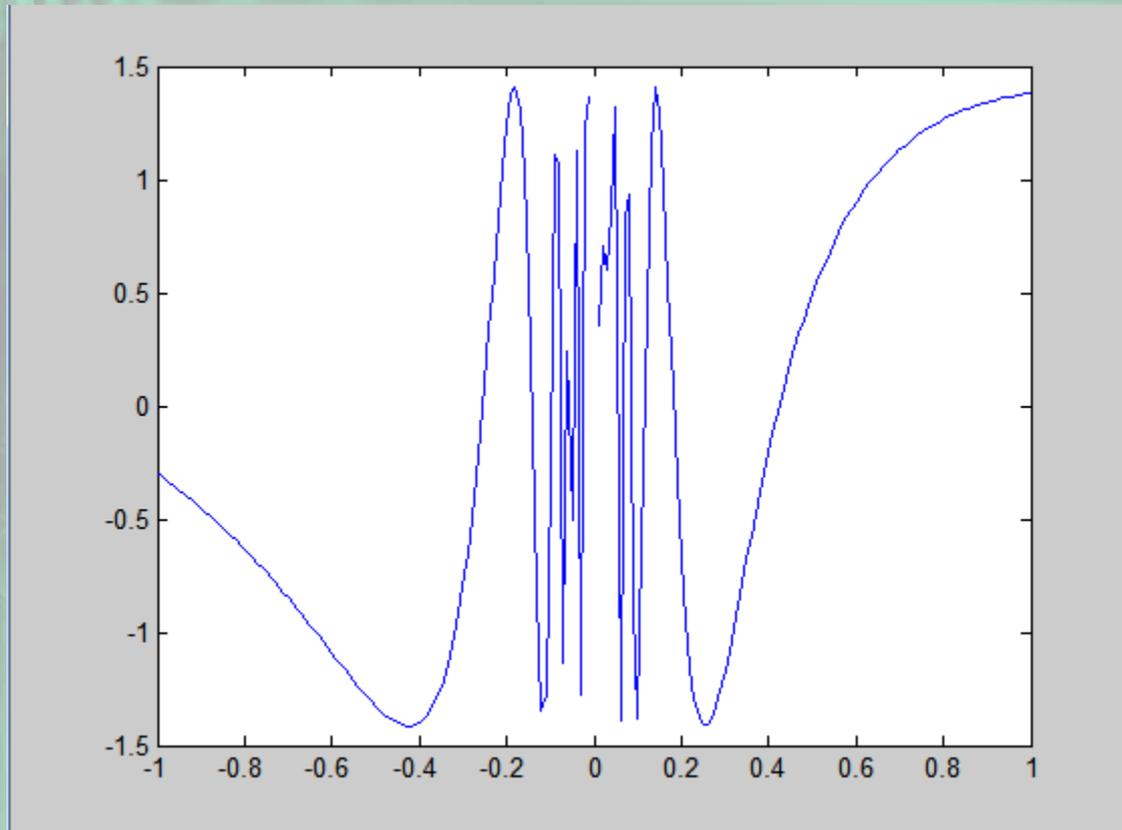
Plot

- More details will be covered in the future!
- Make use of vector.
 - E.g. plot of $y = \sin\left(\frac{1}{x}\right) + \cos\left(\frac{1}{x}\right)$
 - How to make it?
 - What will happen on the point where x is equal to 0?

Plot

- More details will be covered in the future!
- Make use of vector.
 - E.g. plot of $y = \sin\left(\frac{1}{x}\right) + \cos\left(\frac{1}{x}\right)$
 - $x = -1:0.01:1;$
 $y = \sin(1./x) + \cos(1./x);$
 $\text{plot}(x,y);$
 - What will happen on the point where x is equal to 0?

Plot



Plot

- A problem from *Calculus (5th ed.)* by James Stewart.
- The population of a certain species in a limited environment with initial population of 100 and carrying capacity 1000 is:

$$P(t) = \frac{100000}{100+900e^{-t}} \quad t \text{ is measured in years}$$

- Graph this function and estimate how long it takes for the population to reach 900

Plot

- A problem from *Calculus (5th ed.)* by James Stewart.
- The population of a certain species in a limited environment with initial population of 100 and carrying capacity 1000 is:

$$P(t) = \frac{100000}{100+900e^{-t}} \quad t \text{ is measured in years}$$

- Graph this function and estimate how long it takes for the population to reach 900
- Answer: 4.394

Loop Structure (*for* loop)

- for <scalar_1> = <vector>
 expression
end
- It can also be nested.
- for <scalar_1> = <vector>
 for <scalar_2> = <vector>
 expression
 end % the end of “for <scalar_2> = <vector>”
end % the end of “for <scalar_1> = <vector>”

Loop Structure (*for* loop)

- Easy problem:
- What will be the value of [a b c d] at last?

- `c = 0; d = 0;`

```
for a = 1:1:10
```

```
    d = d + 1;
```

```
    for b = 1:2:10
```

```
        c = c + 1;
```

```
    end
```

```
end
```

Loop Structure (*for* loop)

- Challenging problem:
- Catalan numbers are named after Eugene Charles Catalan. They are a sequence of numbers, which are very important in counting problem. So example, the Catalan number C_n can be viewed as the number of different methods to dissect a regular polygon with n sides. We can conclude that:

$$C_n = \frac{1}{n-1} \binom{2n-4}{n-2} \quad (n \geq 2, n \in \mathbb{N})$$

Calculate C_n for a certain n

Loop Structure (*for* loop)

- Hint:
- How to use a nested *for* loop to calculate $\binom{2n-4}{n-2}$?
- How to use “/” during the division here? How to use “./” during the division here?