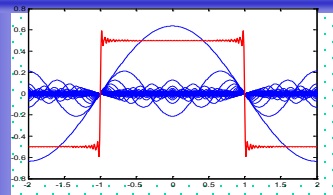

# 信息大类平台课：信号与线性系统
# 第一章 绪论

## 课外实践 Matlab编程与简单应用

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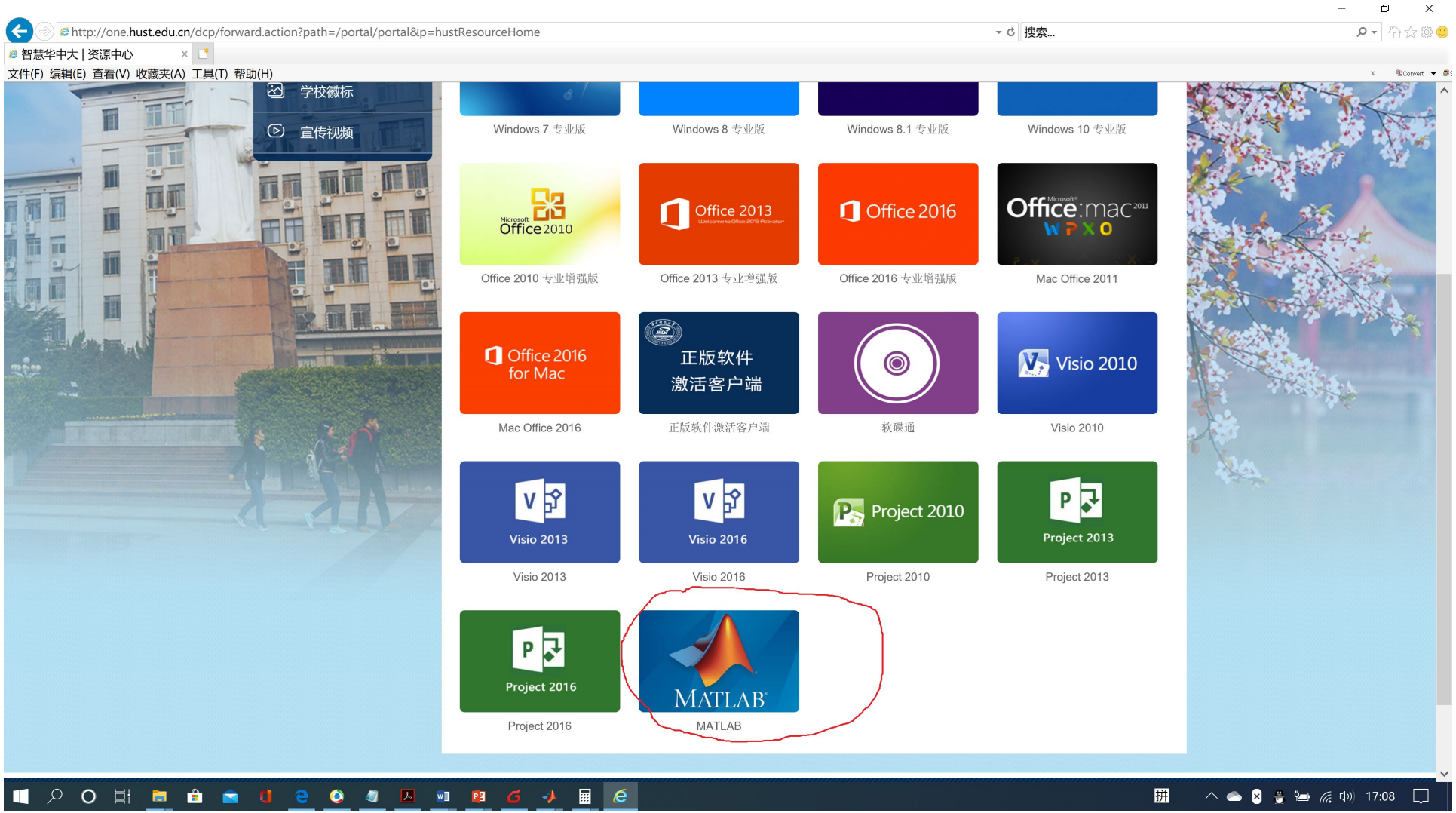
# Overview

- MATLAB的下载与安装
- Getting Help
- Matrix
- Language
- Functions in MATLAB
- Visualization and Graphics

# 0. MATLAB的下载与安装

# MATLAB的下载

- 下载：进入智慧华中大-资源中心，在正版软件中下载



# MATLAB的下载与安装

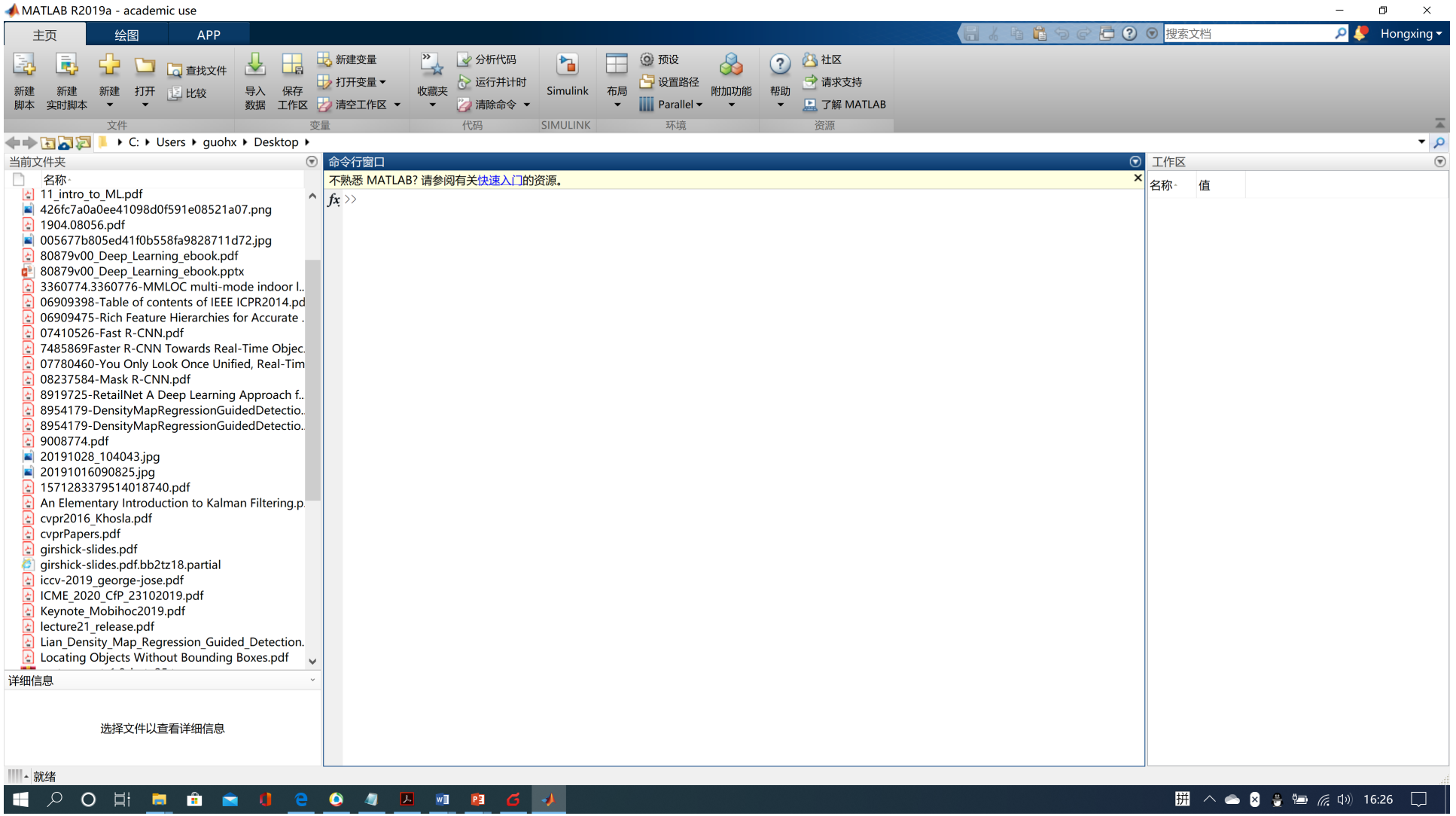
- 安装：根据网页链接上的说明步骤进行安装

# 1. Getting help

# Getting Started

- Log in (Windows or Unix)
- Create a directory ‘ssLab’
- Start Matlab
  - Change to directory ‘sslab’
    - Either >>cd ssLab
    - Or use the path browser

# MATLAB's Workspace



# MATLAB's Workspace

- **who,whos** - current variables in workspace
- **save** - save workspace variables to *.mat file
- **load** - load variables from *.mat file
- **clear all** - clear workspace variables

# MATLAB Basics

- Where to get help?

1) In MATLAB's prompt type:

**help, lookfor,helpwin, helpdesk, demos.**

2) On the Web:

**http://www.mathworks.com/support**

# 2. Matrix

# Matrices in MATLAB

- Matrix is a main MATLAB's data type
- How to build a matrix?

**A = [ 1 2 3; 4 5 6; 7 8 9 ];**

Creates matrix A with size 3x3.

- Special matrices :

**zeros(n,m), ones(n,m),eye (n,m)**

# Basic Operations on Matrices

- All the operators in MATLAB defined on matrices : **+, -, *, /, ^, sqrt, sin, cos** etc.
- Element wise operators defined with preceding dot : **.*, ./, .^** .
- size(A) - size vector
- sum(A) - columns sums vector
- sum(sum(A)) - all the elements sum

# Relational Operators

- **== , < , > , *(not equal)*~= ,*(not)*~**
- **find('condition')** - Returns indexes of A's elements that satisfies the condition.

# Relational Operators(cont.)

- Example:

```
>> A = [1 2; 3 4], I = find(A<4)

A =

     1     2
     3     4

I =
     1
     2
     3
```

# 3. Language

# Logical Operators and Functions

- Operators
  - & AND
  - | OR
  - ~ NOT
- Functions
  - Xor
  - All
  - any

# Logical Operators and Functions

- Examples
  - A=[1 2 0;0 4 5];
  - B=[1 –2 3;0 1 1];
  - A & B
  - Ans=
  - 1 1 0
  - 0 1 1
  - Xor(A,B)
  - Ans=
  - 1 0 0
  - 1 1 0

# Flow Control

- MATLAB has five flow control constructs:
  - if statements
  - switch statements
  - for loops
  - while loops
  - break statements

# if

- **IF** statement condition.

  The general form of the **IF** statement is

  **IF** expression

  statements

  **ELSEIF** expression

  statements

  **ELSE**

  statements

  **END**

# if(cont.)

- Example:

```
if I == J
  A(I,J) = 2;
elseif abs(I-J) == 1
  A(I,J) = -1;
else
  A(I,J) = 0;
end
```

# switch

- **SWITCH** - Switch among several cases based on expression.
- The general form of the SWITCH statement is:

```
SWITCH switch_expr
  CASE case_expr,
    statement, ..., statement
  CASE {case_expr1, case_expr2, case_expr3,...}
    statement, ..., statement
 ...
  OTHERWISE,
    statement, ..., statement
 END
```

# switch (cont.)

- Note:
  - Only the statements between the matching
  - CASE and the next CASE, OTHERWISE, or END are executed.
  - **Unlike C**, the SWITCH statement does not fall through
  - (so BREAKs are unnecessary).

# for

- **FOR** Repeat statements a specific number of times.

- The general form of a FOR statement is:

  FOR variable = expr, statement, ..., END

# for (cont.)

- Example:

```
FOR I = 1:N,
        FOR J = 1:N,
            A(I,J) = 1/(I+J-1);
        END
END
```

# while

- **WHILE** Repeat statements an indefinite number of times.
- The general form of a **WHILE** statement is:

```
WHILE expression
    statements
END
```

# while (cont.)

- Example:

```
E = 0*A; F = E + eye(size(E)); N = 1;
while norm(E+F-E,1) > 0,
        E = E + F;
        F = A*F/N;
        N = N + 1;
end
```

  - EYE(N) is the N-by-N identity matrix.
  - NORM(X) is the largest singular value of X, max(svd(X)).

# Break and continue

- Break
  - BREAK terminates the execution of FOR and WHILE loops.In nested loops, BREAK exits from the innermost loop only.
  - BREAK is not defined outside of a FOR or WHILE loop.Use RETURN in this context instead.
- Continue
  - CONTINUE passes control to the next iteration of FOR or WHILE loop in which it appears, skipping any remaining statements in the body of the FOR or WHILE loop.
  - In nested loops, CONTINUE passes control to the next iteration of FOR or WHILE loop enclosing it.

# 4. Functions in MATLAB

# Scripts and Functions

- There are two kinds of M-files:
  - **Scripts**, which do not accept input arguments or return output arguments. They operate on data in the workspace.
  - **Functions**, which can accept input arguments and return output arguments. Internal variables are local to the function.

# Functions in MATLAB

- **FUNCTION** Add new function.

- New functions may be added to MATLAB's vocabulary if they are expressed in terms of other existing functions.

# Functions in MATLAB (cont.)

- Example :

  The existence of a file
  on disk called STAT.M with:

```
function [mean,stdev] = stat(x)
%STAT Interesting statistics.
n = length(x);
mean = sum(x) / n;
stdev = sqrt(sum((x - mean).^2)/n);
```

  defines a new function called STAT that calculates the
  mean and standard deviation of a vector.

# 5. Visualization and Graphics

# Visualization and Graphics

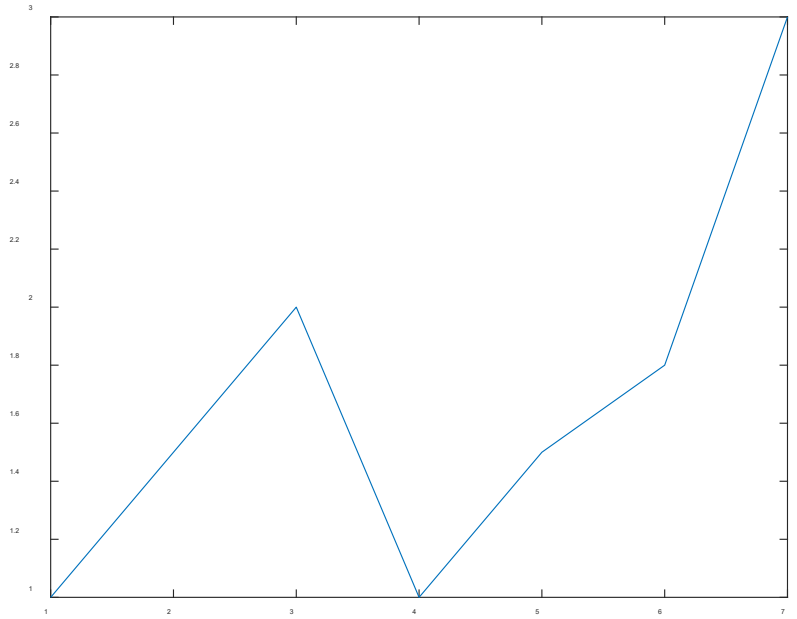
- **plot(x,y), plot(x,sin(x))** - plot 1-D function
- **figure , figure(k)** - open a new figure
- **hold on, hold off** - refreshing
- **mesh(x_ax,y_ax,z_mat)** - view surface
- **contour(z_mat)** - view z as top. map
- **subplot(3,1,2)** - locate several plots in figure
- **axis([xmin xmax ymin ymax])** - change axes
- **title('figure title')** - add title to figure

# An example-plot

- x=[1 1.5  2 1 1.5 1.8 3 ]
- x =

1.0000  1.5000  2.0000  1.0000  1.5000  1.8000  3.0000

>> plot(x)



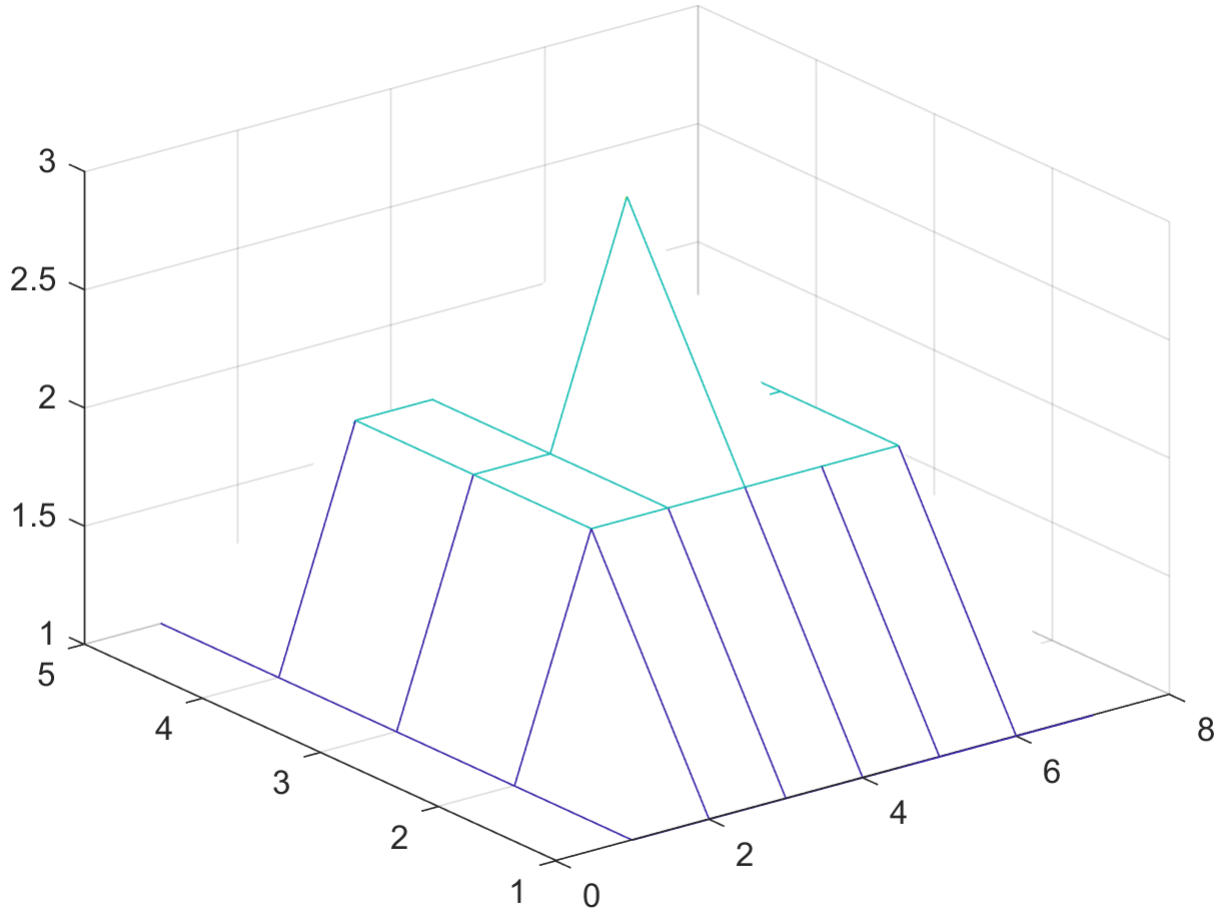
# An example-mesh

- z=[1 1 1 1 1 1 1
  1 2 2 2 2 2 1
  1 2 2 3 2 2 1
  1 2 2 2 2 2 1
  1 1 1 1 1 1 1]

- z =

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 2 | 2 | 2 | 2 | 2 | 1 |
| 1 | 2 | 2 | 3 | 2 | 2 | 1 |
| 1 | 2 | 2 | 2 | 2 | 2 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

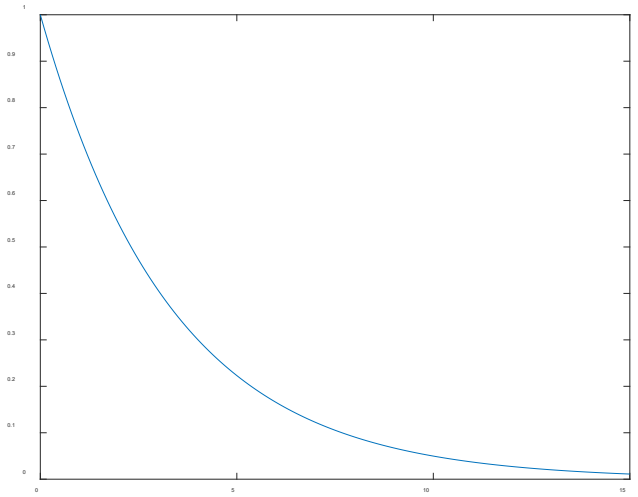
>> mesh(z)



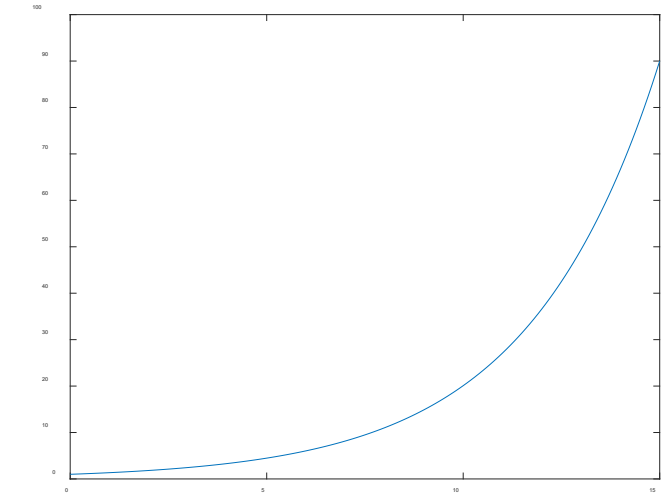
# 画实指数信号的波形曲线

$$y(t) = e^{\sigma t}$$

- 若σ = 0, $y(t)$为常数信号
- 若σ<0, $y(t)$为指数衰减信号(1)
- 若σ>0, $y(t)$为指数增长信号(2)



$1.\sigma < 0$



$2.\sigma > 0$

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lec01p2020.m

```
%To plot the curve of a real exp signal
%Ver0.1-April 10,2020
%Author: Prof. Guo Hongxing

sigma1=0.3;sigma2=-0.3;
n=1;
for t=0:0.1:15
    tt(n)=t;
    f1(n)=exp(sigma1*t);
    f2(n)=exp(sigma2*t);
    n=n+1;
end

plot(tt,f1);
figure;
plot(tt,f2);
```

命令行窗口

**画实指数信号的波形曲线的Matlab代码**

# 课外实践

- 安装并学习使用Matlab
- 用Matlab编程画出第1讲中“振幅指数调制的正弦信号”的波形曲线图

- 郭老师在武汉为同学们加油！