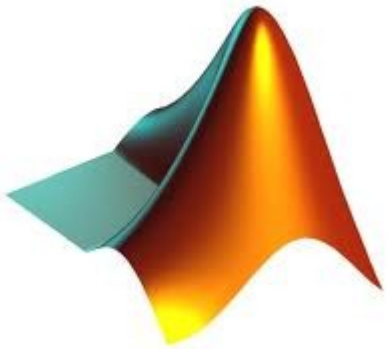
Úvod do MATLABu

Cvičenia z Počítačového Videnia

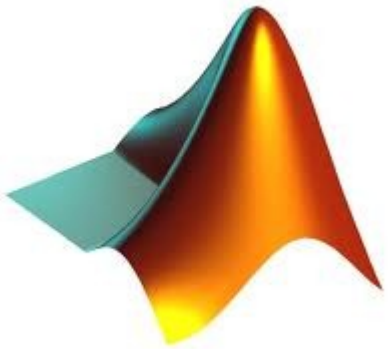
MATLAB

- Pôvodne: Interaktívny program na operácie s maticami
- Teraz: Vysoko úrovňový jazyk na technické výpočty a interaktívne prostredie na: tvorbu algoritmov, vizualizáciu a analýzu dát a numerické výpočty



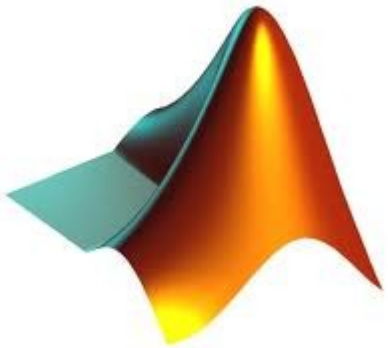
MATLAB

- Interaktívny nástroj na analýzu, návrh a riešenie problémov
- Matematické funkcie pre lineárnu algebru, štatistiku, Fourierovu analýzu, filtrovanie...
- Funkcie na vizualizáciu 2D a 3D dát
- Nástroje na vytvorenie GUI



MATLAB

- Využitie: spracovanie signálu, spracovanie obrazu, testovanie a meranie, finančné modelovanie a analýza, výpočtová biológia...
- Toolboxy rozširujú prostredie MATLAB na riešenie tried problémov z konkrétnych oblastí

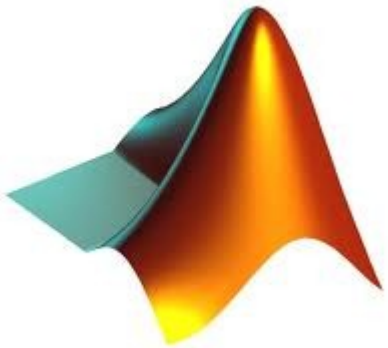


MATLAB- Functions

- Function list

http://www.mathworks.com/help/matlab/functionlist-alpha.html

- Tutorial:
  - http://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf



Toolbox

- Image Processing Toolbox
- Image Acquisition Toolbox
- Video and Image Processing Blockset
- Iné Toolboxy: Statistics, Bioinformatics, Wavelet, Fuzzy Logic, Econometrics

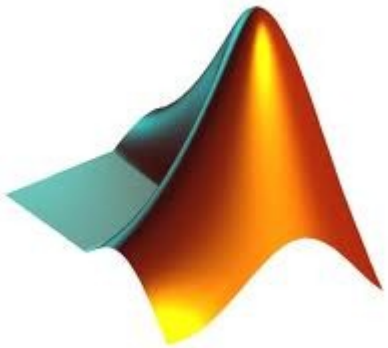
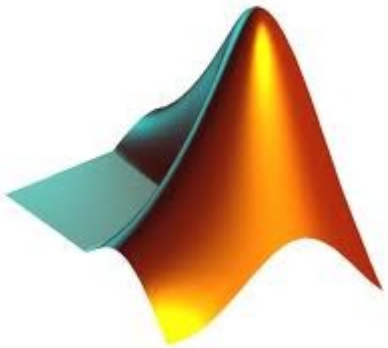


Image Processing Toolbox

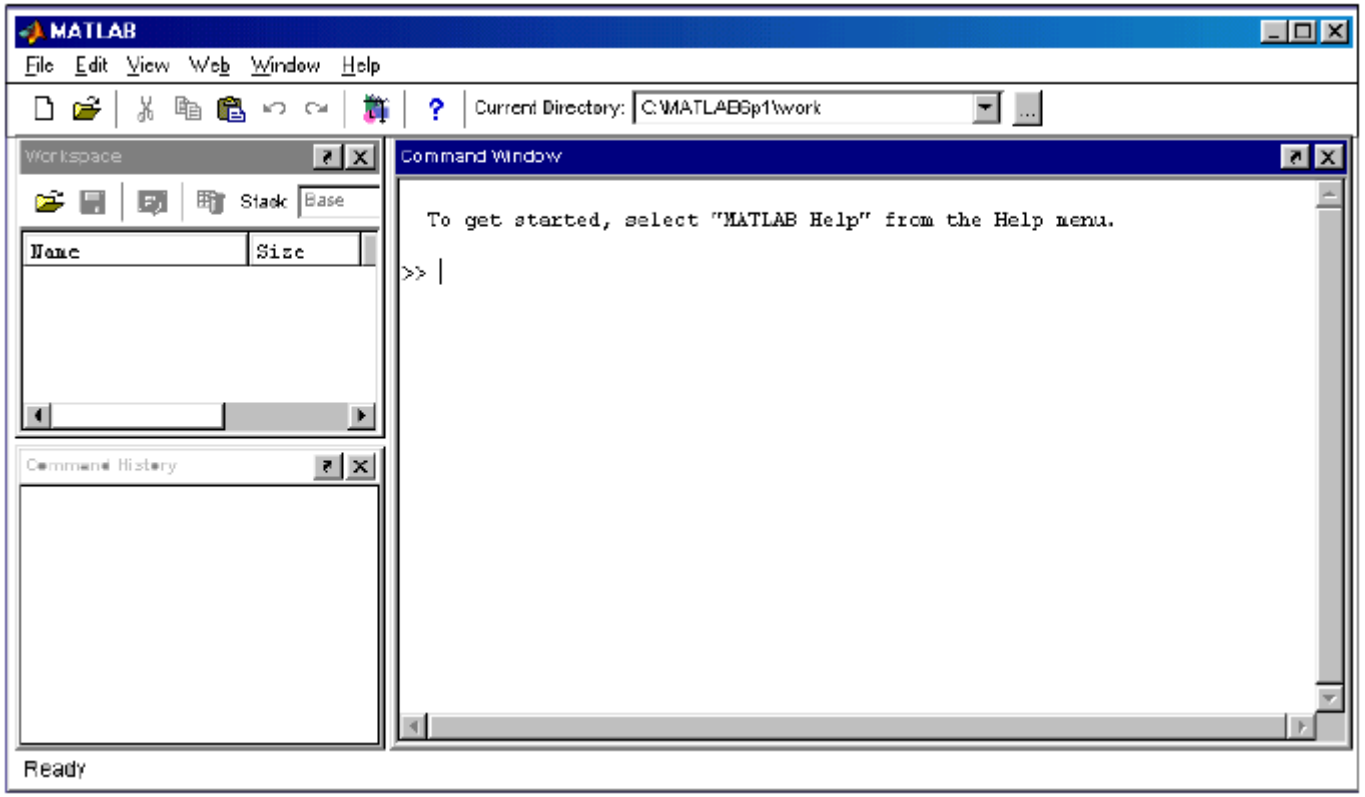
- Image Analysis- segmentácia, matematická morfológia, extrakcia príznakov, detekcia hrán
- Spracovanie obrazu- zvýšenie kontrastu, prevod medzi farebnými modelmi
- FFT, DCT
- Zobrazovanie sekvencií obrázkov a videa

Toolbox

- Video and Image Processing Blockset: algoritmy a nástroje na dizajn a simuláciu spracovania videa a počítačového videnia
- Image Acquisition Toolbox: umožňuje získavať obrázky a video priamo do MATLABu

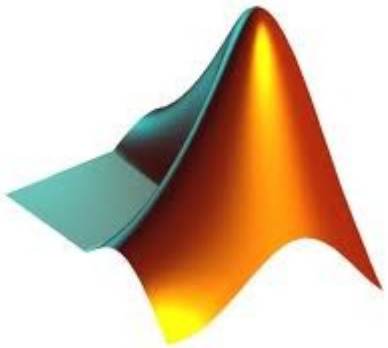


Okno MATLABu



Okno MATLABu

- Command window- na písanie príkazov, výstupy, chyby
- Workspace- premenné, ich hodnoty a typy
- Command History- použité príkazy sa dajú „drag and drop“ do command window

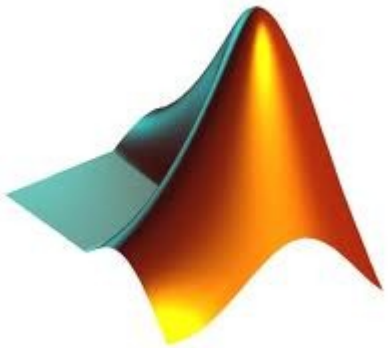


Demos

- >> demo
- Záložka Demos
- 3D Visualisation
- Teapot, Images and Colormaps
-

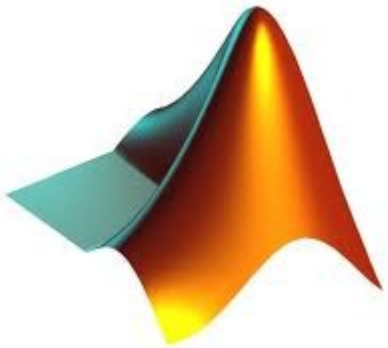
>> help commandname

>> lookfor keyword



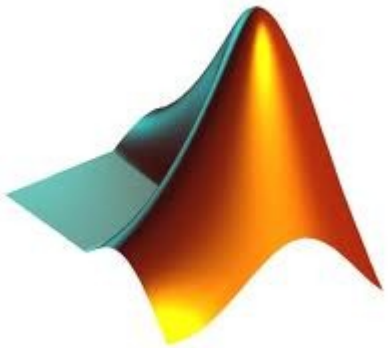
Command window

- 3 + 4 - 7
- t = 3 + 4 - 7
- k = 3 + 4 - 7;
- k
- k;
- 3^2*4
- 2+2 / 1+1



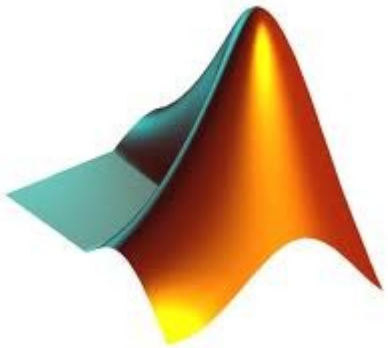
Command window

- 1/0 (Inf)
- 0/0 (NaN)
- MATLAB je Case Sensitive!
- K a k sú rôzne premenné
- 15 miest, ale ukazuje len 5
- format long / format short



Command window

- MATLAB má množstvo vstavaných fcií
- sin, cos, tan, asin, acos
- sin(pi/2)
- log, log10, log2
- log10(100)

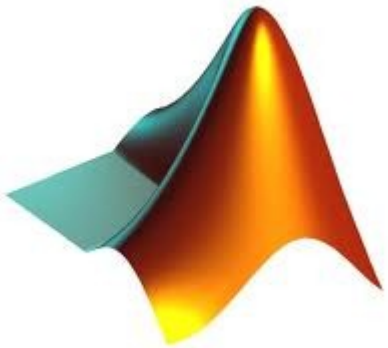


Vektory

- v = [1, 2, 3, 4]
- v = [1 2 3 4]
- v = [1; 2; 3; 4]
- Workspace: tabuľka, graf
- v = start: step: end
- v = 2:2:9 v = [2, 4, 6, 8]
- v = 2:5 v = [2, 3, 4, 5]

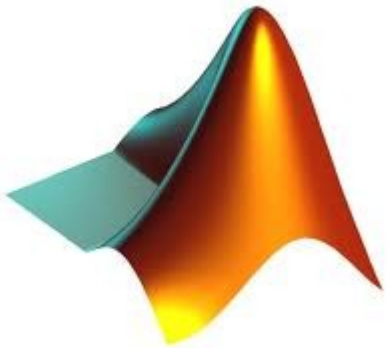
Vektory

- v = linspace(1, 5, 10)
- v (4) = 0
- v (5:7) = 0
- v (1: 2: 7) = 0



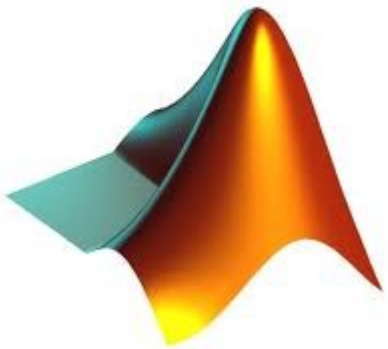
Matice

- M = [1 2; 3 4; 5 6]
- M = [1 2 3; 3 4; 5 6] Error
- M(1, 2)
- M(1, :)
- M (: ,2)
- M(:) = jeden stlpec



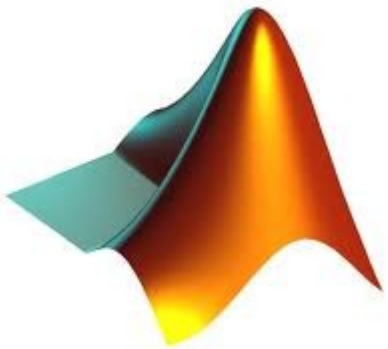
Matice

- p = zeros(3, 3) == zeros(3);
- o = ones(3, 3) == ones(3);
- r = rand(3, 3) == rand(3);
- r = rand(1,4)
- k = magic(3);



Maticové operácie

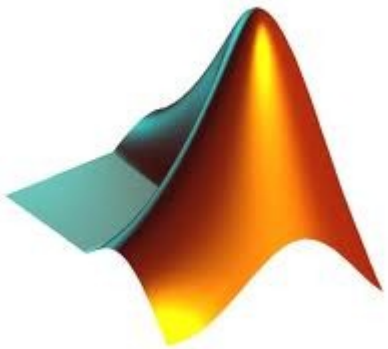
- a = [1 1; 1 1] , b = [2 2; 2 2]
- a*b
- a*2
- b^2
- b.^2



Výpočet lineárnych rovníc

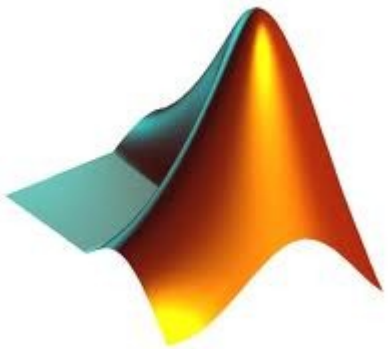
$$\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 1 \\ 3 & 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ 7 \end{bmatrix}$$

- A = [0 1 2; 1 2 1; 3 5 2]
- b = [1; 3; 7]
- x = A\b == A.^(-1)*b



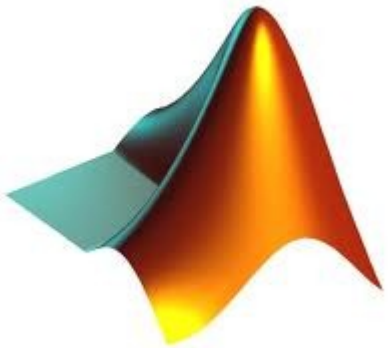
Graf $y = x^2$

- x = linspace(0, 5, 100);
- y1 =x;
- plot(x,y1); grid;
- y2 = x.^2;
- y3 = x.^3;
- plot(x,y1, x,y2, x,y3); grid;



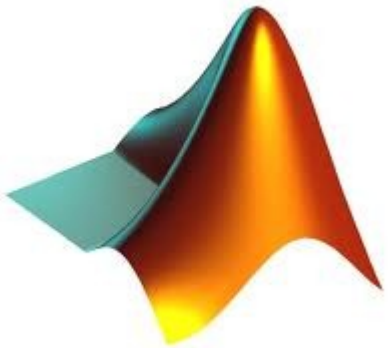
Polia

- v = zeros (1,100);
- Funkcie pre 1D polia:
- sum, max, min, sort, mean
- s = sum(v);



Reťazce

- s = 'string'
- l =length(s);
- s(3)
- Strcmp, findstr



Symboly

Symbol	Represents	Symbol	Represents
>	Greater than	>=	Greater or equal to
<	Less than	<=	Less or equal to
~=	Not equal to	= =	Equal to
Not	~	And	&
Or	| (single vertical line)		

What If...

- if sum(v) == 0

  b= 10;

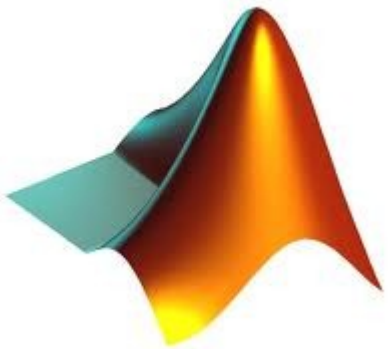
  end
- if b-1 < 3

  a= 4;

  else

  a =5;

  end

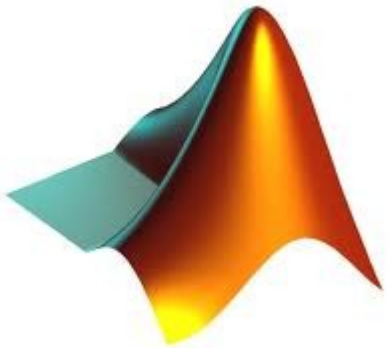


Cyklus

- for k = 1:100

  v(k)= k;

  end



MATLAB špecialitka

- Chceme vytvoriť pole kde

$$v(p) = \frac{p}{\sin(p) + 2}$$

- 1: for p = 1:1000

  v(p) = (p/sin(p)+2); end
- 2: v = zeros (1, 1000);

  for p = 1:1000

  v(p) = (p/sin(p)+2); end
- 3: p = 1:1000

  v = (p./sin(p)+2)

MATLAB špecialitka

- Chceme vytvoriť pole kde $v(p) = \frac{p}{\sin(p)+2}$
- 1: for p = 1:1000

  v(p) = (p/sin(p)+2); end 1.82 sec
- 2: v = zeros (1, 1000);

  for p = 1:1000 0.16 sec

  v(p) = (p/sin(p)+2); end
- 3: p = 1:1000 0.0083 sec

  v = (p./sin(p)+2)

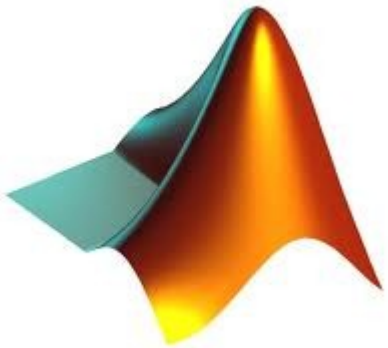
M-files

- MATLAB funkcie sa píšu ako m súbory
- prvy.m meno súboru = názov fcie
- function x = prvy (v)

  x = v (1);
- Volanie:
- y = zeros(1,4); x = prvy (y);
- prvy(y); uloží x do ans

M-files

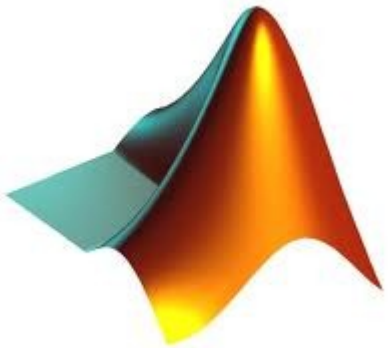
- function [x,y,z] = prvy(v)
- prvy(v); uloží do ans len x
- Function [ ] = prvy(v)
- % komentare



Subfunkcie

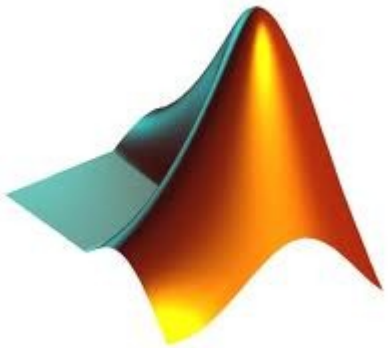
```
function x = myfun(y)
% volanie subfunkcie
x = subfn(2);

%definovanie subfunkcie
function a = subfn(b)
a=b*3;
```



Výpis textu

- fprintf ('Hello World!');
- fprintf ('Hodnota x je %g', x);
- Nieje vhodné pre vektory
- \n nový riadok
- %g kompaktný zápis
- %c jeden znak
- %e exponenciálny zápis
- %s string



Timing

- tic; prikazy; toc;
- V sekundách
- V m -file

  t0 = cputime

  ....príkazy, výpočty

  t1 = cputime

  fprintf('vypočet trval %g', t1- t0)