

MJERENJE BRZINE I PROCENE PROTOKA U OTVORENIM TOKOVIMA

- Vektrino – Gordana Jelovac
- Elektromagnetna sonda-Martina Janković
- Ultrazvučna papuča – Ivana Đurić
- Matlab – Milivoj Vasiljević



MERENJA U HIDROTEHNICI



Student :

Gordana Jelovac

Građevinski fakultet - Univerzitet u
Beogradu

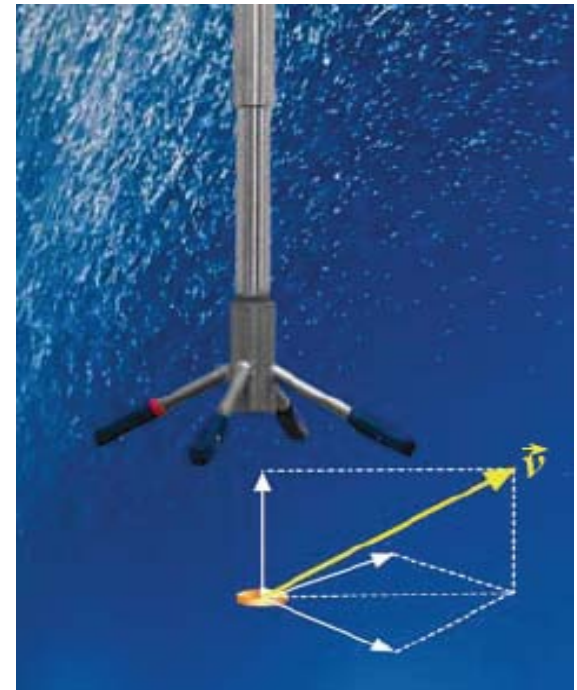
CILJ

- Predstavljanje nove generacije senzora za merenje brzine vode u 3 dimenzije - 3D



PRINCIP RADA SONDE

- Sonda radi po principu **Doplerovog efekta**



SPECIFICATIONS

WATER VELOCITY MEASUREMENT

Range: ± 0.01 , 0.1, 0.3, 1, 2, 4m/s (software selectable)

Accuracy: $\pm 0.5\%$ of measured value ± 1 mm/s

Sampling rate (output) 1–25Hz, 1–200Hz (Vectrino⁺ firmware only)

Internal sampling rate: 200–5000Hz

SAMPLING VOLUME

Distance from probe: 0.05m

Diameter: 6mm

Height (user selectable): 3–15mm

DOPPLER UNCERTAINTY (noise)

Typ. uncertainty at 25Hz: 1% of velocity range

SPECIFICATIONS

ECHO INTENSITY

Acoustic frequency: 10 MHz

Resolution: 0.45 dB

Dynamic range: 60 dB

SENSORS

Temperature Range: -4°C to 40°C

Accuracy/Resolution: 1°C / 0.1°C

Time response: 5 min

ENVIRONMENTAL

Operating temperature: -5°C to 45°C

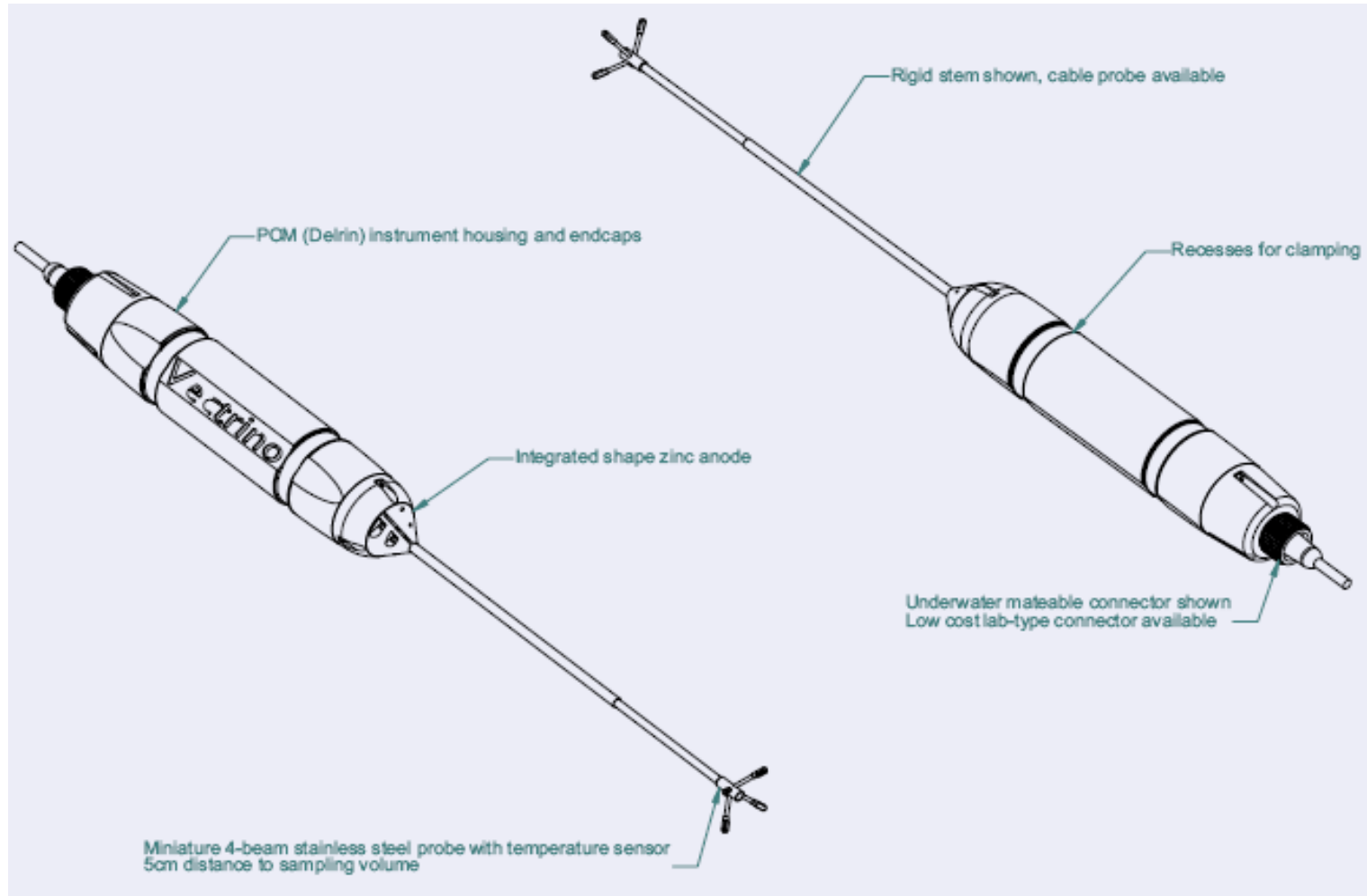
Storage temperature: -15°C to 60°C

Shock and vibration: IEC 721-3-2

SOFTWARE (VECTRINO)

Operating system: Windows[®]98, Windows NT[®] 4.0,
Windows[®]2000, Windows[®]XP

TEHNIČKI OPIS

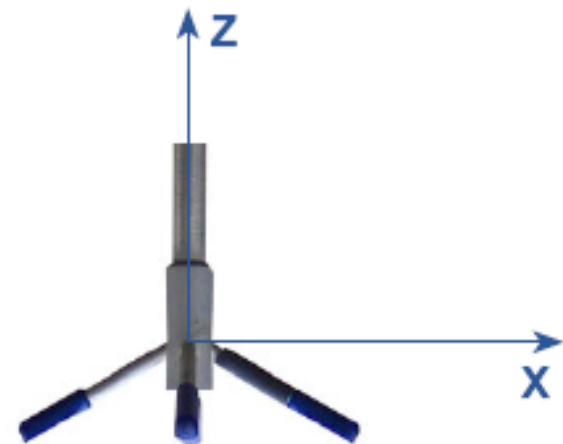
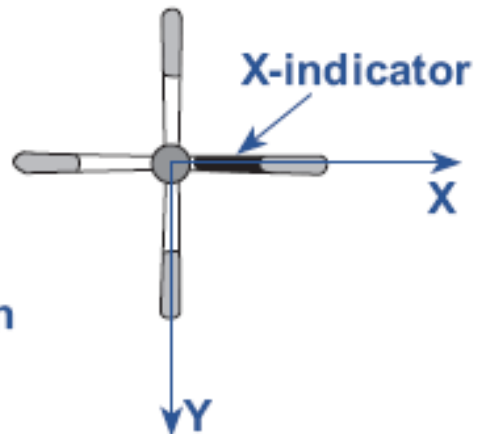
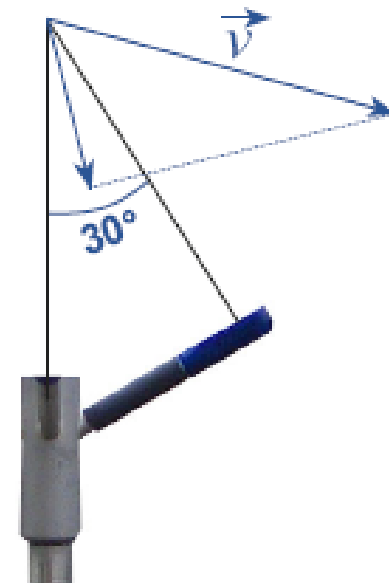
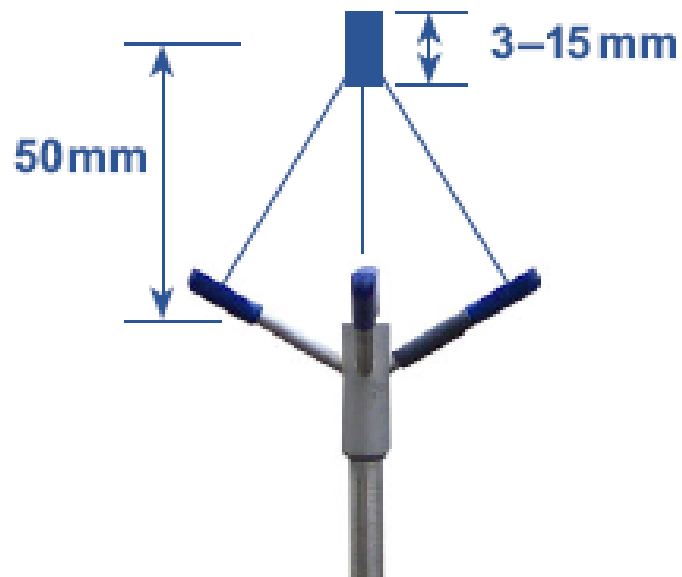


OPERATIVNI PRINCIP

- Emituju se zvučni talasi od 10 MHz
- Zvučni talasi se odbijaju od suspendovanih čestica koje se nalaze u vodi
- Receiveri prihvataju eho

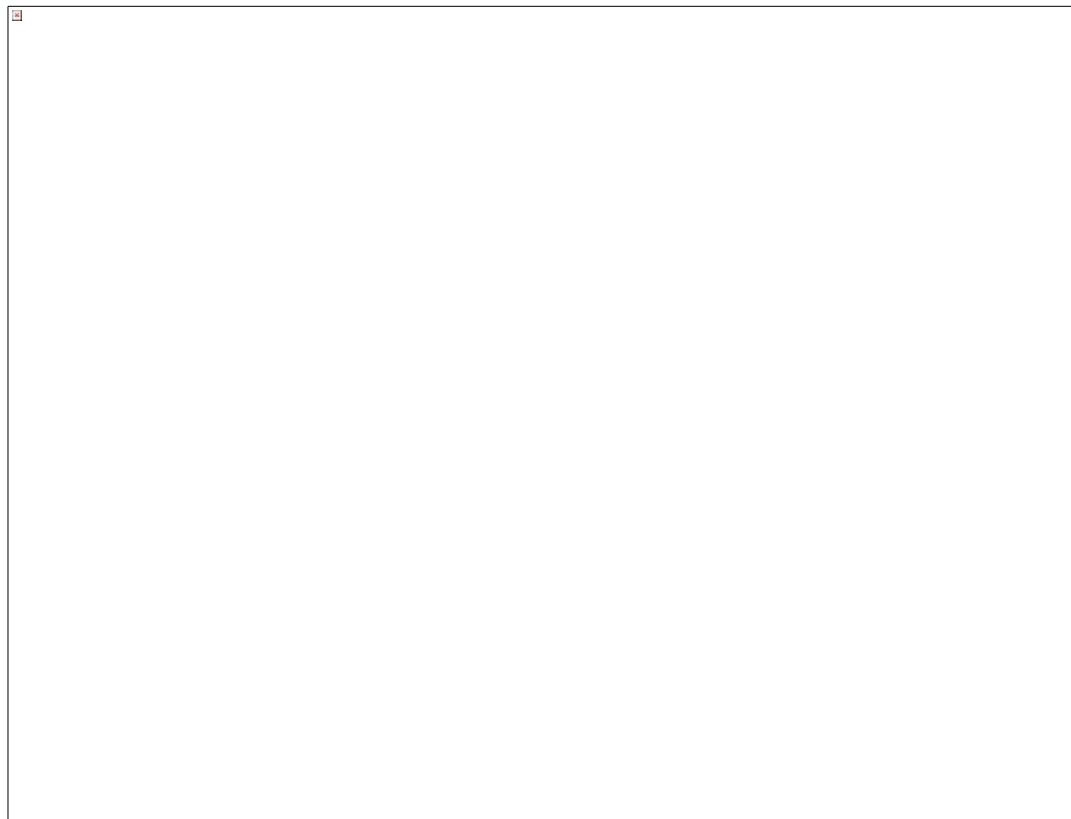


GEOMETRIJA



REZULTATI MERENJA

- Signali sva četiri
risivera koja se
medjusobno
uporedjuju radi
dobijanja
najverovatnije brzine



- Rezultati mogu biti prikazani i u XYZ koordinatnom
sistemu

PROBLEMI

- Velika osetljivost receptora na udar;
- Voda mora sadržati suspendovane čestice;

SONDA U AKCIJI

-Prva probna merenja u laboratoriji



Hvala Vam na pažnji



Mjerenja u hidrotehnici

ELEKTROMAGNETNA SONDA

Student:

Martina Janković 307/02

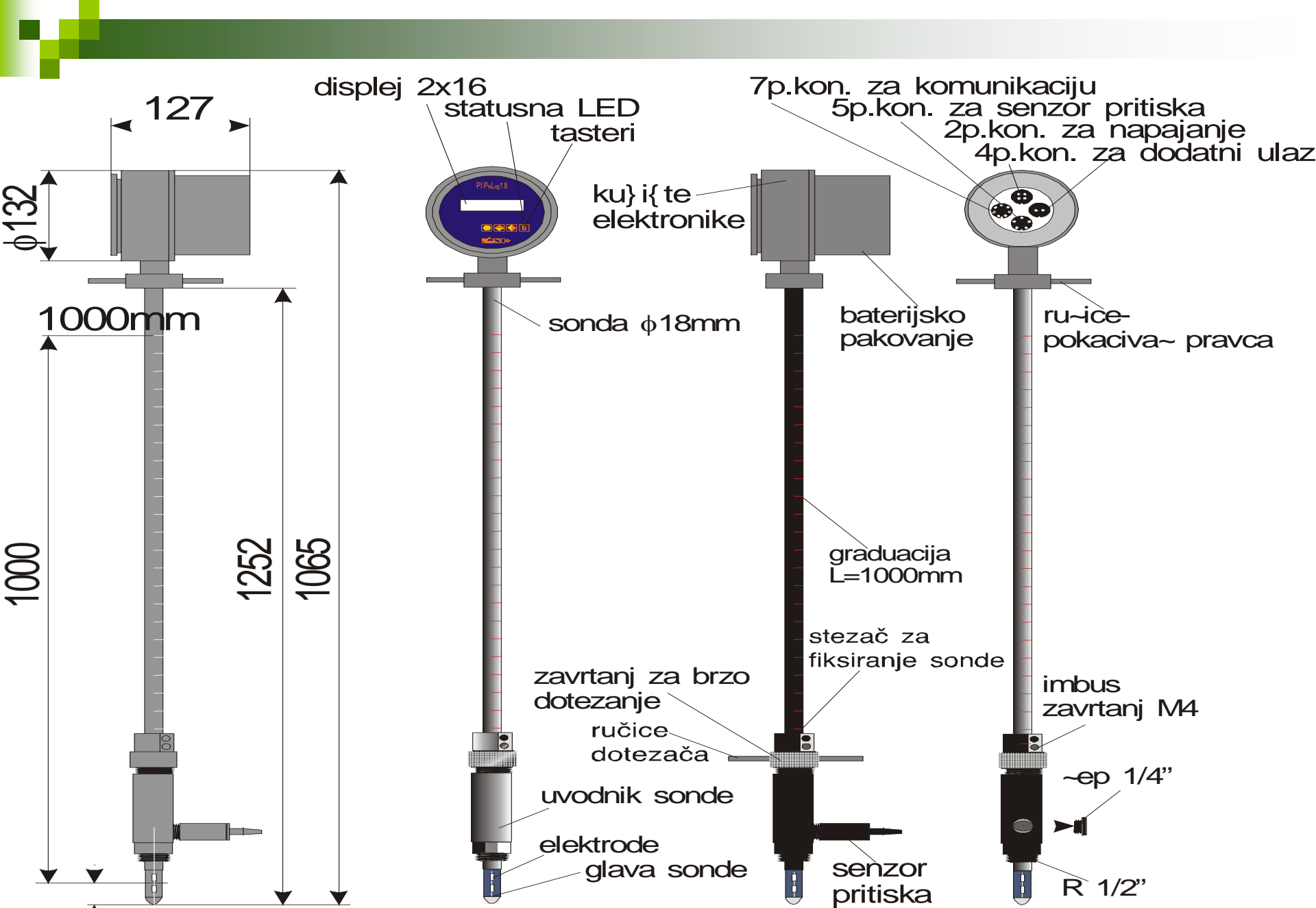
Kako je sve počelo?

- Prvi industrijski elektromagnetni mjerači protoka datiraju iz ranih pedesetih godina prošlog vijeka

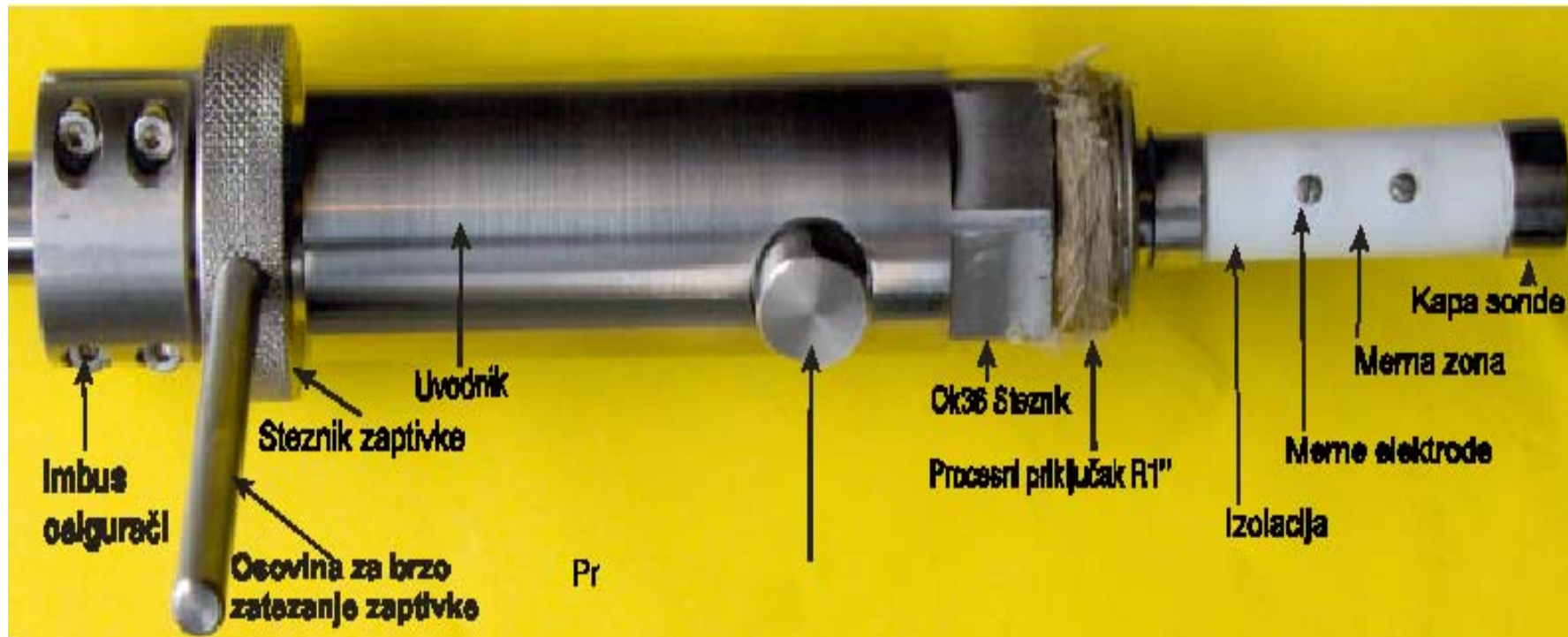


Osnovna namjena

- Elektromagnetna sonda mjeri brzinu provodne tečnosti koja se kreće između njenih elektroda



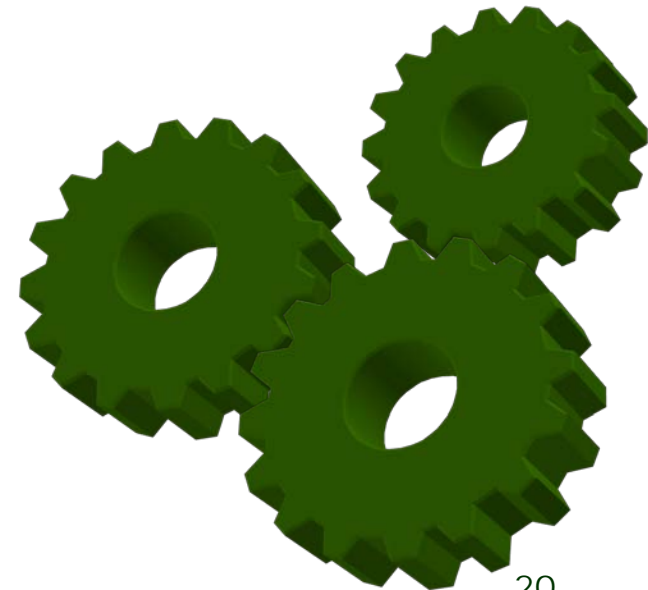
Uvodnik



Senzor pritiska

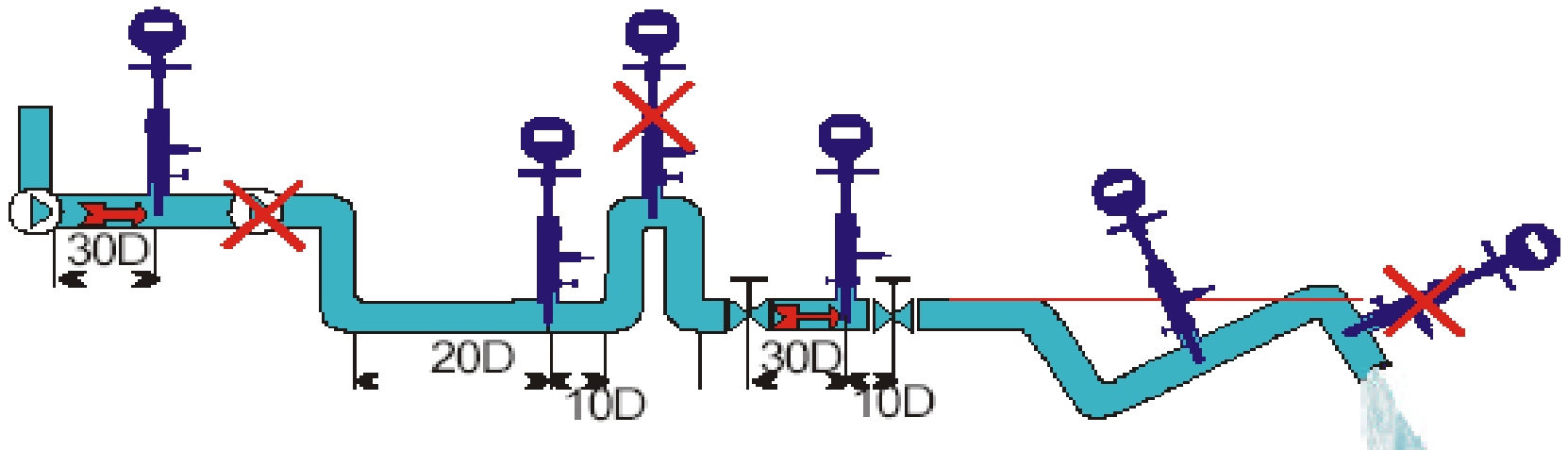


- Izbor mjernog mjesta
- Priprema mjernog mjesta



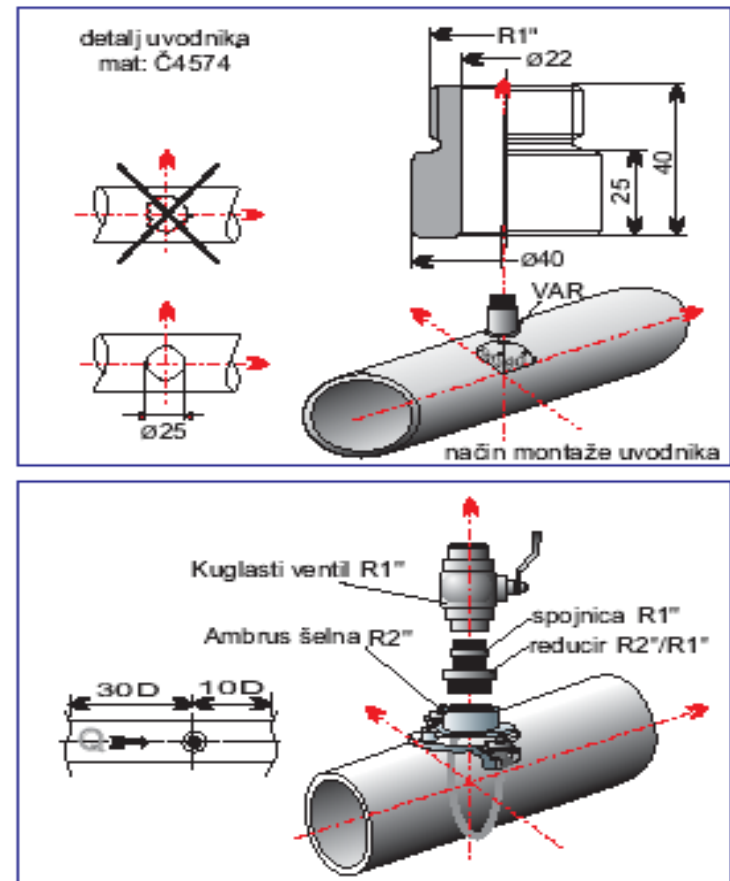
Izbor mjernog mjesta

- Osnovne preporuke



Priprema mjernog mjesta

- Laka priprema i adaptacija mjernog mjesta



Korisni savjeti tokom upotrebe

- Pažljivo rukovanje
- Izbjegavati grebanje površine elektroda drugim materijalima, posebno metalima
- Izbjegavati nanošenje masnoća na elektrode
- Ne izlagati sondu naglim promjenama temperature



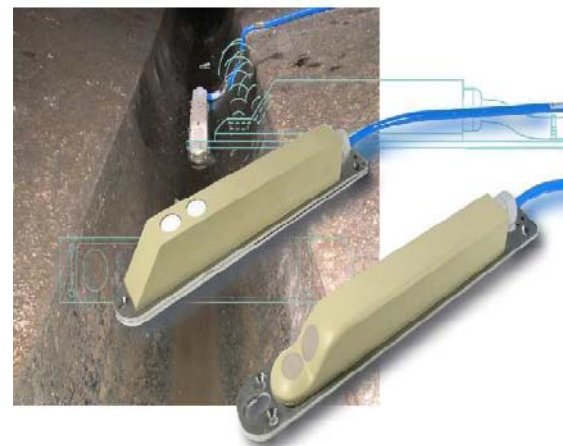
HVALA NA PAŽNJI

MERENJA U HIDROTEHNICI

ULTRAZVUČNA PAPUČA

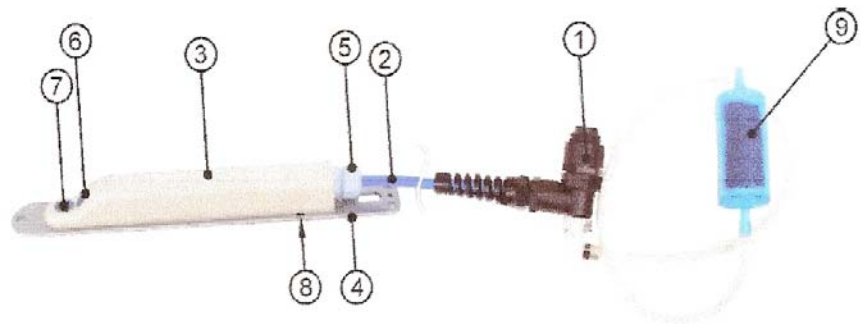
CILJ

- Merenje protoka u otvorenim tokovima



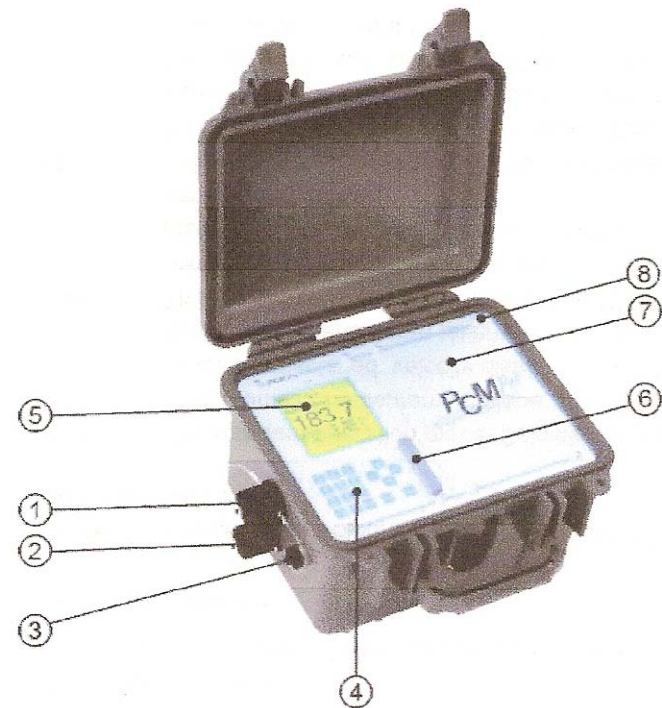
NIVUS

1. Konektor sa zavrtnjem
2. Kabel senzora
3. Telo senzora
4. Limena osnova
5. Učvršćivač kabla
6. Senzor za merenje brzina
7. Senzor za merenje dubina
8. Senzor za merenje nivoa preko pritiska
9. Filter



NIVUS

1. Priključak za senzor
2. Priključak za senzor
3. Priključak za računar
4. Tastatura
5. Displej
6. Slot za memorijsku karticu
7. Baterija
8. Navrtanj

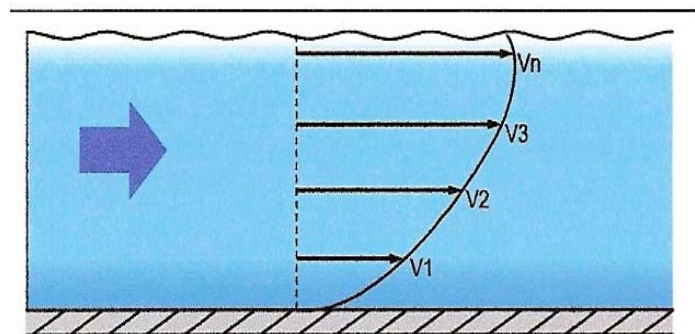


PRINCIP RADA

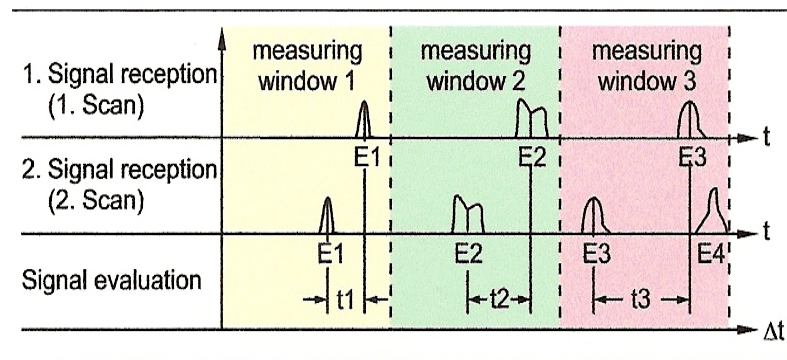
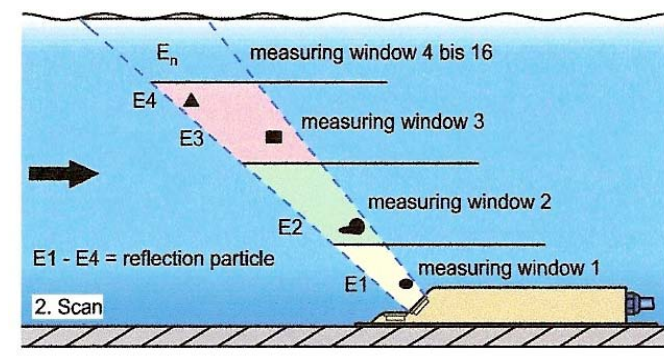
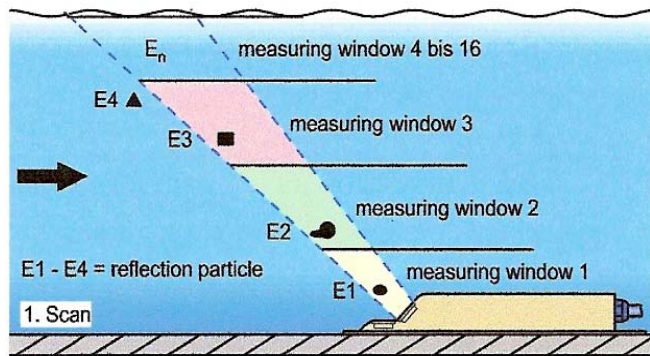
- Protok se ne meri direktno

$$Q = A \cdot V$$

$$h_1 = c \cdot t_1 / 2$$



METODA KORELACIJA



SPECIFIKACIJA

- Frekvencija merenja 1 MHz
- Temperatura -20 C do +50 C
- Pritisak max.4 bar(senzor za merenje pritiska max. 1.0 bar)
- Duzina kabla 10/15/20/30/50 m za senzor sa pritiskom, bez 250 m

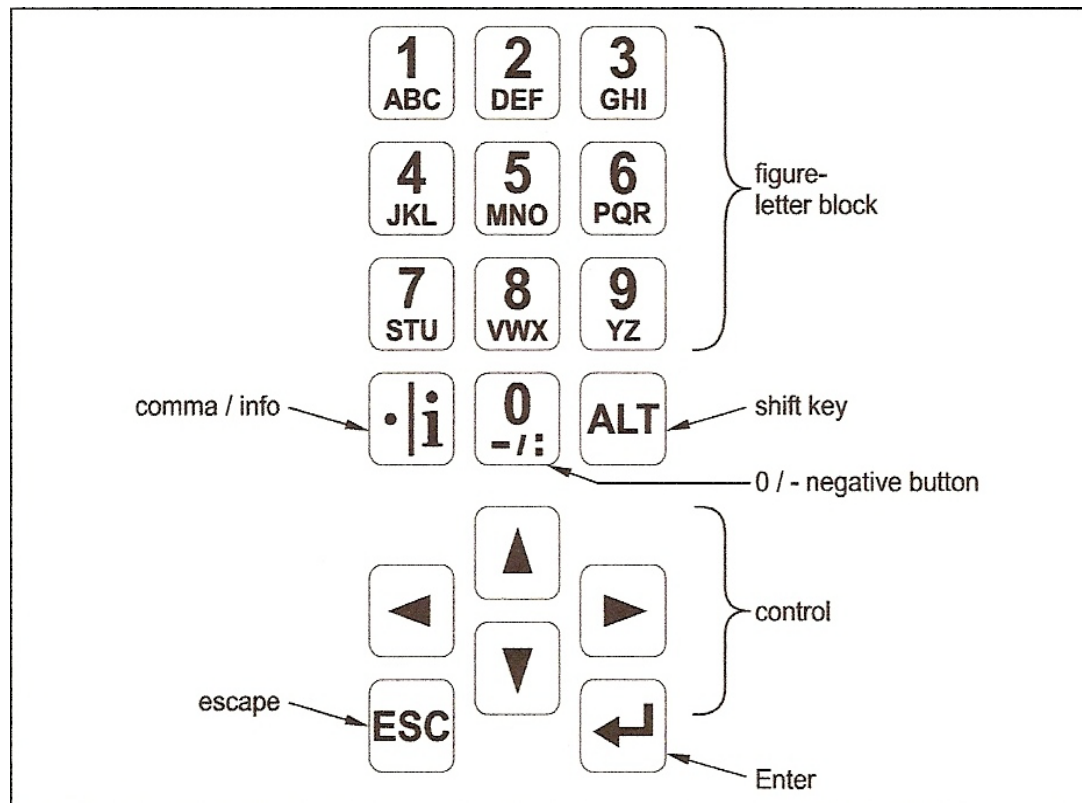
MERENJE NIVOA

- Opseg merenja 0-200 cm, najniži 4 cm
- Tačnost 2mm

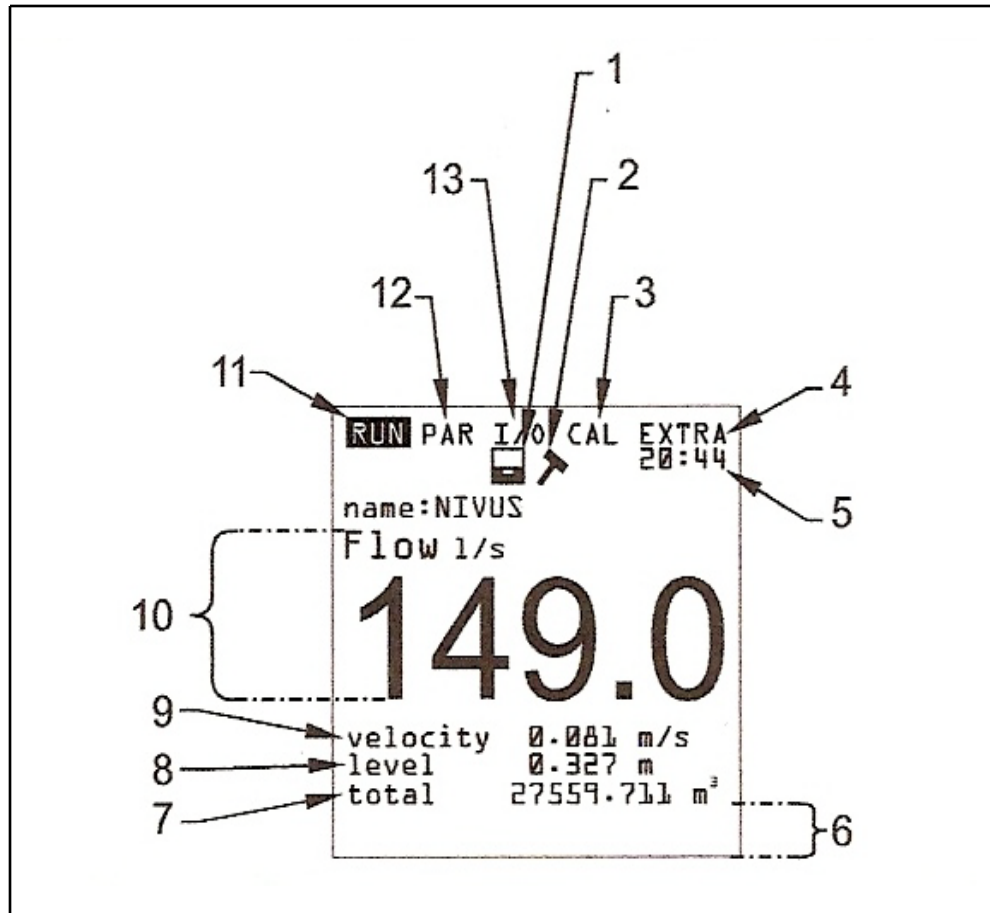
MERENJE BRZINA

- Opseg merenja -100 cm/s do +600 cm/s
- Tačnost 1% od merene vrednosti ili
5 mm/s po sloju

TASTATURA



DISPLEJ



PREDNOSTI

- Lako prenosiv
- Visoka tačnost
- Nije potrebna kalibracija
- Merenje u teško zagađenim sredinama

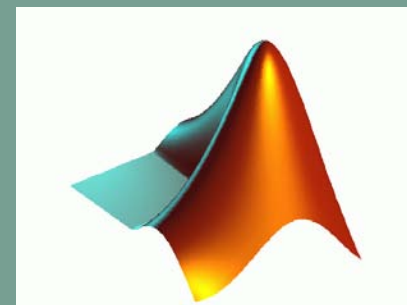
MANE

- Pretpostavka da je temperatura konstantna
- Mala kontrolna zapremina



Mjerenja u hidrotehnici

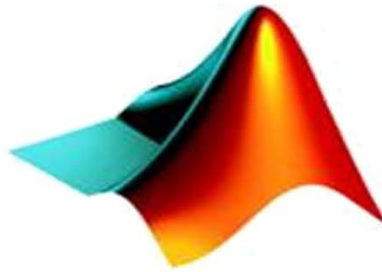
Matlab



Osnove Grafičke mogućnosti Istorijat



Milivoj Vasiljević



MATLAB®

Šta je matlab i što čini?!

- Šta- Matlab je softverski paket namenjen rešavanju problema predstavljenih u obliku *vektora i matrica*
- Što (čini)- rešava matematičke probleme, vrši njihovu analizu i vizuelizuje ih

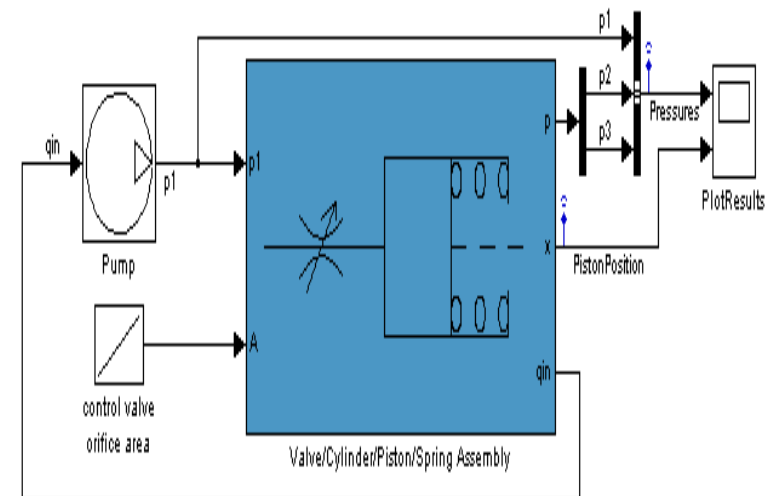


Šta je simulink i što čini?! 

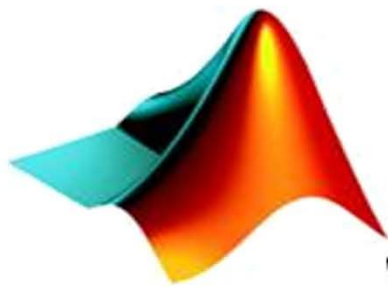
Single Hydraulic Cylinder Simulation

- Šta- Simulink je softverski paket koji nam omogućava da modeliramo, simuliramo, analiziramo *dinamičke sisteme*

- Što(čini)- simulira nelinearne i dinamičke sisteme



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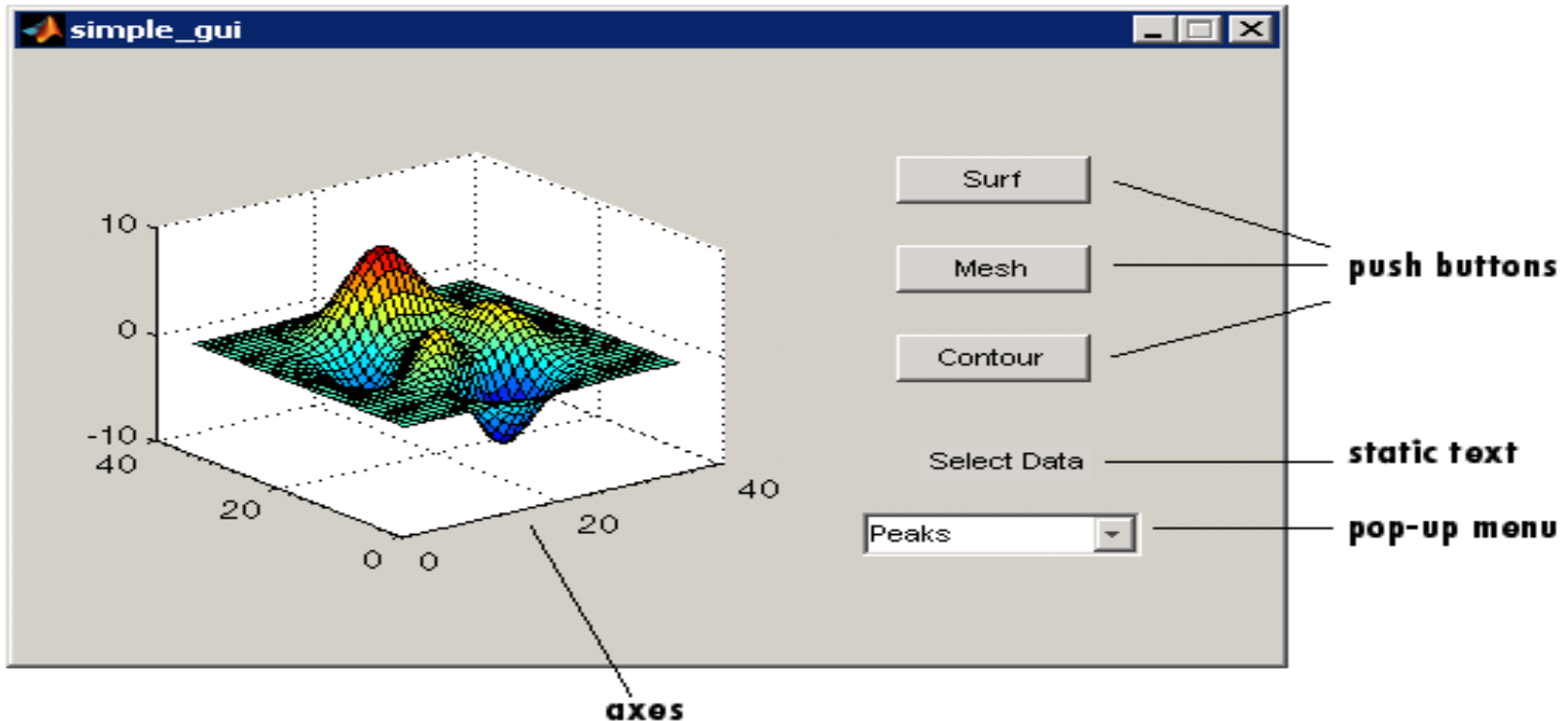
MATLAB[®] SIMULINK[®]

Modeliranje i simulacija modela u realnom vremenu; animacija, analiza nelinearnih, kontinualnih dinamičkih sistema

Numerička analiza, razvoj algoritama, modeliranje dinamičkih, nelinearnih, stohastičkih, diskontinualnih sistema, njihova konverzija, kompajler m-fajlova, f.je više matematike, paketna obrada podataka

Example: Simple GUI

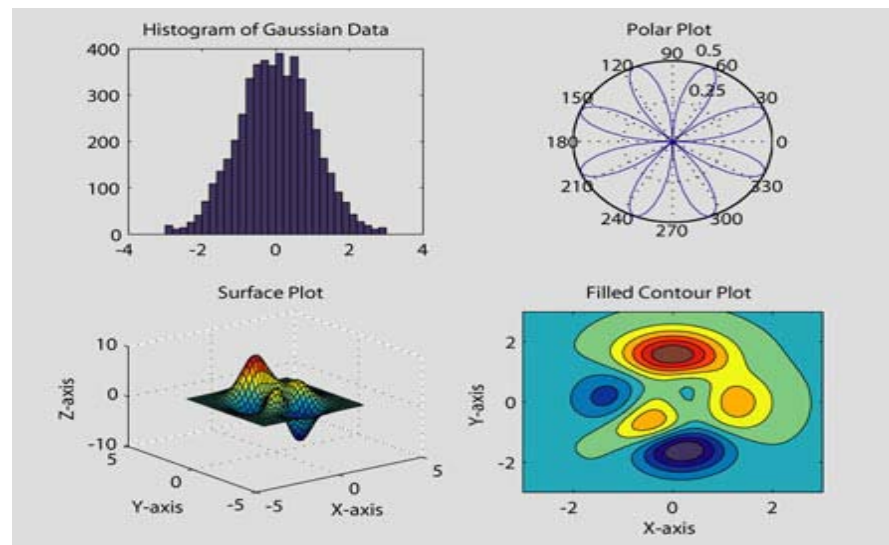
This chapter shows you how to write a script that creates the example graphical user interface (GUI) shown in the following figure.

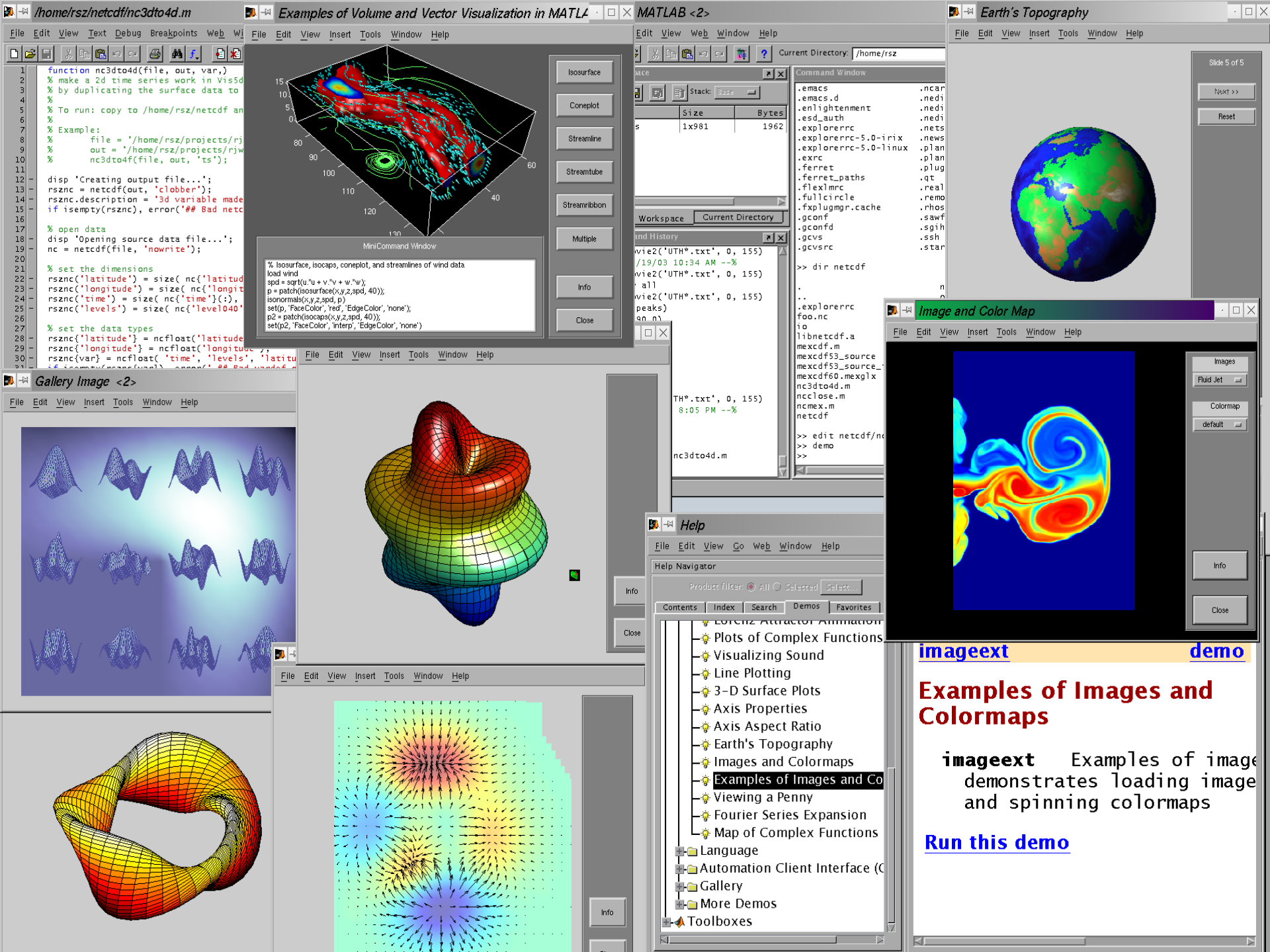


*novije verzije donose mogućnost vizuelnog kreiranja korisničkog interfejsa (GUI) pomoću ugrađenog programa GUIDE.

Grafičke mogućnosti

- Iscrtavanje funkcija u kvadratnim i polarnim k.sys, crtanje histograma, iscrtavanje površina, animacije





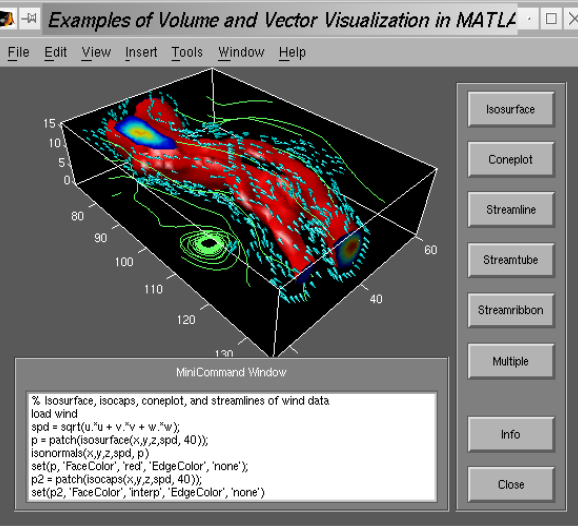
```
function nc3dto4d(file, out, var,)
% make a 2d time series work in Vis5d
% by duplicating the surface data to
%
% To run: copy to /home/rsz/netcdf and
%
% Example:
% file = '/home/rsz/projects/rjw
% out = '/home/rsz/projects/rjw
nc3dto4d(file, out, 'ts');

disp 'Creating output file...';
rsznc = netcdf(out, 'lobber');
rsznc.description = '3d variable made
if isempty(rsznc), error('## Bad netc

% open data
disp 'Opening source data file...';
nc = netcdf(file, 'nowrite');

% set the dimensions
rsznc('latitude') = size(nc('latitude
rsznc('longitude') = size(nc('longit
rsznc('time') = size(nc('time')(:);
rsznc('levels') = size(nc('level040

% set the data types
rsznc('latitude') = ncfloat('latitude
rsznc('longitude') = ncfloat('longitud
rsznc(var) = ncfloat('time', 'levels', 'latitu
if isempty(rsznc), error('## Bad netcdf
```



```
Current Directory: /home/rsz

Command Window
.emacs .ncar
.emacs.d .nedi
.enlightenment .nedi
.esd_auth .nedi
.exploreerrc .nets
.exploreerrc-5.0-irix .news
.exploreerrc-5.0-linux .plan
.exrc .plan
.ferret .plug
.ferret_paths .qt
.flexlirc .real
.fullcircle .remo
.fxplugmgr.cache .rhos
.gconf .sawf
.gconfd .sgih
.gcvsc .ssh
.gcvsrc .star

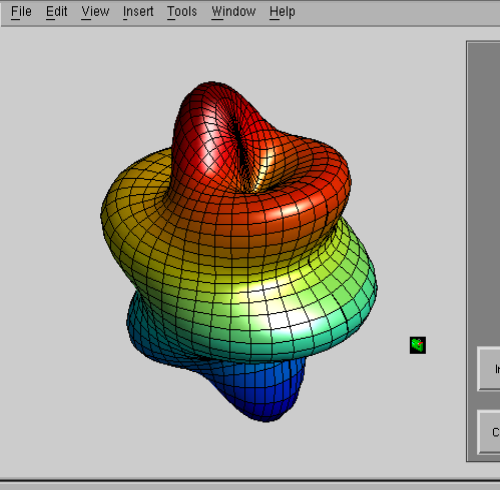
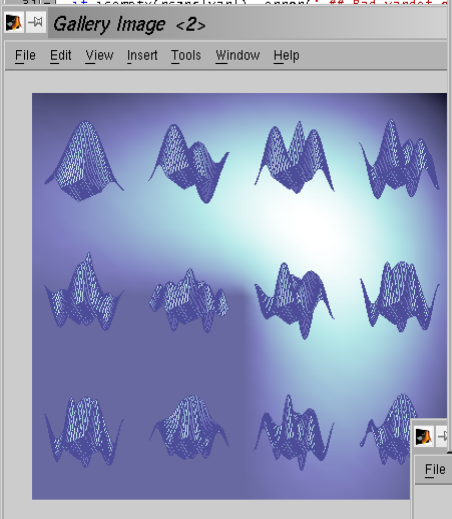
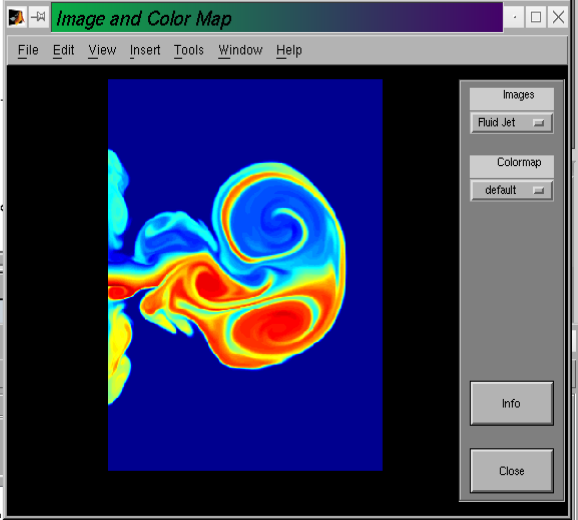
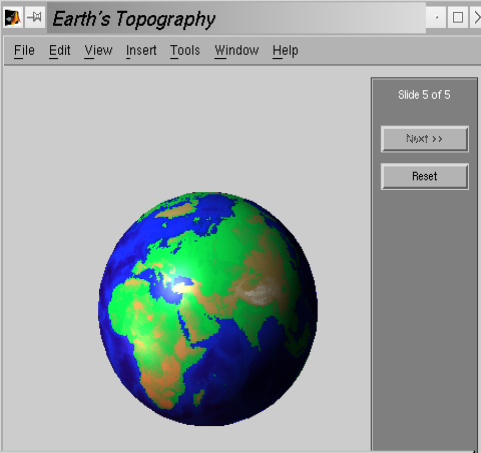
>> dir netcdf
..
.exploreerrc
foo.nc
io
libnetcdf.a
mexcdf.m
mexcdf53_source
mexcdf53_source.c
mexcdf60.mexglx
nc3dto4d.m
ncclose.m
ncmex.m
netcdf

>> edit netcdf/nc
>> demo
>>

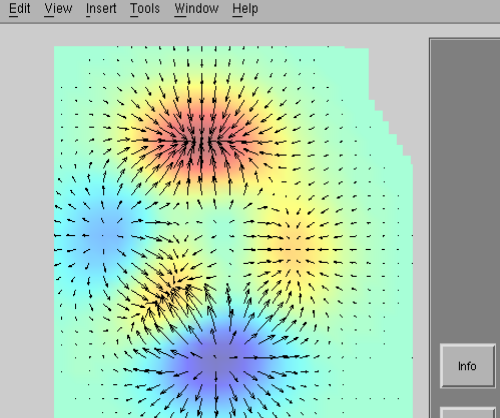
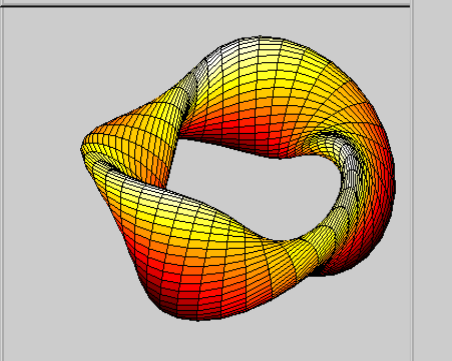
vie2('UTH*.txt', 0, 155)
/19/03 10:34 AM --%
vie2('UTH*.txt', 0, 155)
'all
vie2('UTH*.txt', 0, 155)
peaks)
an ny

TH*.txt', 0, 155)
8:05 PM --%

nc3dto4d.m
```



- Help
- File Edit View Go Web Window Help
- Help Navigator
- Product files: All Selected
- Contents Index Search Demos Favorites
- ↳ Lorenz Attractor Animation
- ↳ Plots of Complex Functions
- ↳ Visualizing Sound
- ↳ Line Plotting
- ↳ 3-D Surface Plots
- ↳ Axis Properties
- ↳ Axis Aspect Ratio
- ↳ Earth's Topography
- ↳ Images and Colormaps
- ↳ **Examples of Images and Co**
- ↳ Viewing a Penny
- ↳ Fourier Series Expansion
- ↳ Map of Complex Functions
- ↳ Language
- ↳ Automation Client Interface (C
- ↳ Gallery
- ↳ More Demos
- ↳ Toolboxes



imageext demo

Examples of Images and Colormaps

imageext Examples of image demonstrates loading image and spinning colormaps

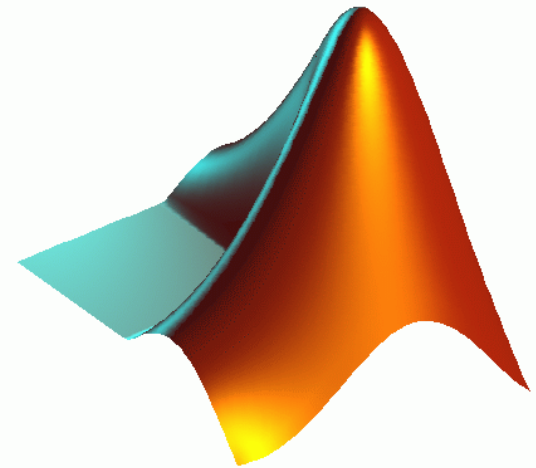
[Run this demo](#)

Istorijat i.. na kraju ipak najčešća upotreba Matlaba i sličnih programskih paketa



Korisni linkovi:

- www.themathworks.com
(zvanični Matlabov sajt)
- www.tutoriali.org (tutoriali i uputstva za Matlab na srpskom)



Zaključak:

*Ako imate posla sa vodom prvo uradite
mjerjenja*

Leonardo da Vinči



HVALA NA PAŽNJI