Innovative Teaching Approaches in development of Software Designed Instrumentation and its application in real-time systems

Practicum of measurement and data acquisition systems

LabVIEW environment

Co-funded by the Erasmus+ Programme of the European Union

Itasdi

Innovative Teaching Approaches in development of Software Designed Instrumentation and its application in real-time systems

Faculty of Technical Sciences

Ss. Cyril and Methodius University
Faculty of Electrical Engineering and Information Technologies

Zagreb University of Applied Sciences

School of Electrical Engineering
University of Belgrade

Faculty of Physics
Warsaw University of Technology

Co-funded by the Erasmus+ Programme of the European Union

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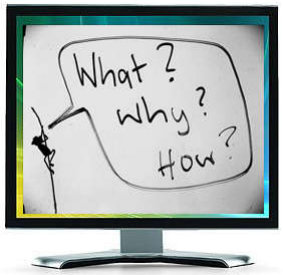
Innovative Teaching Approaches in development of Software Designed Instrumentation and its application in real-time systems

Praktikum iz merno-akvizicionih sistema

LabVIEW okruženje

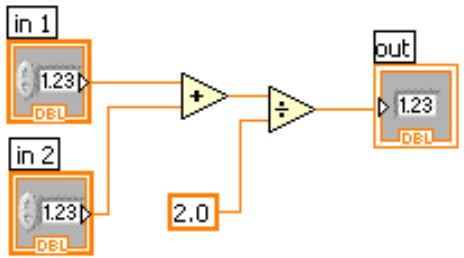
Co-funded by the Erasmus+ Programme of the European Union



Šta je LabVIEW?

- **Lab**oratory **V**irtual **I**nstrumentation **E**ngineering **W**orkbench
- Grafičko programsko okruženje (G programski jezik)

LabVIEW Code	Function Pseudo Code

	function average (in1, in2, out)
	{
	out = (in1 + in2)/2.0;
	}

- National Instruments (Austin, Texas)
- 1986. LabVIEW 1 → 2018. LabVIEW 2018
- OSNOVNA namena:

  VIRTUELNA instrumentacija za MERENJE i UPRAVLJANJE

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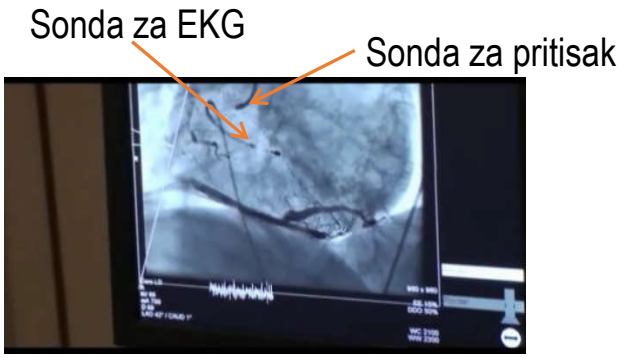
Zašto LabVIEW?

- Ušteda u vremenu pri dizajniranju i korekciji aplikacije
- Primer: brza izmena programa prilikom intrakardijalnog snimanja u operacionoj sali



Klinički centar Srbije, kardiološka klinika
Sala za kateterizaciju

BMIT

Beogradski Univerzitet, Elektrotehnički fakultet
Laboratorija za
BioMedicinsku Instrumentaciju i Tehnologije

Istraživanje: dr Miloš Kostić , dr Matija Štrbac, dr Milan Dobrić

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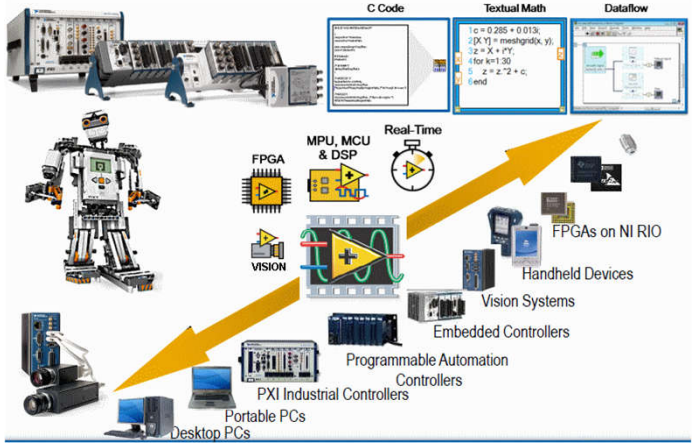
Zašto LabVIEW?

- Podržava hardver National Instruments-a, ali i drugih proizvođača
- Dostupan za različite operativne sisteme
- Kompatibilan sa drugim programskim jezicima
- Bogata biblioteka funkcija

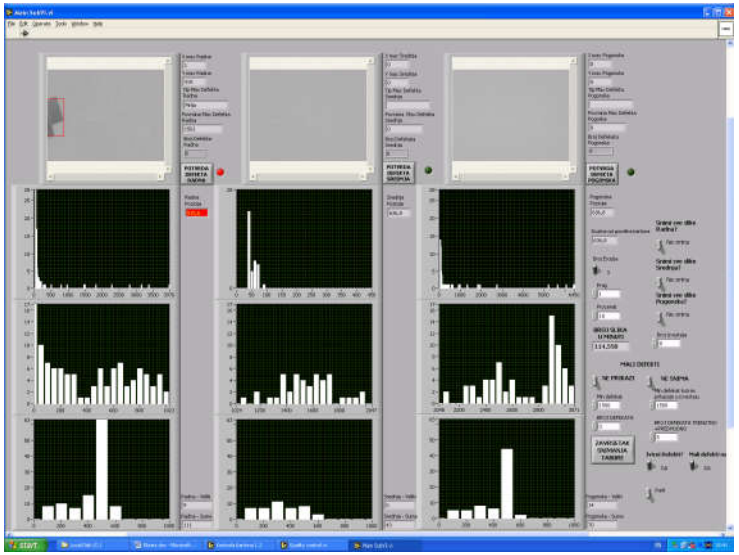
  (+dodatni moduli)

ALI...

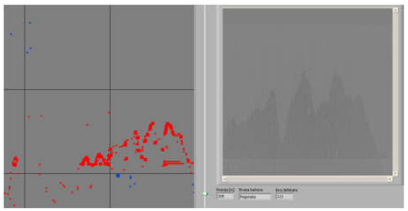


Itasdi

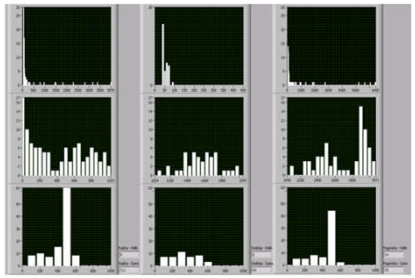
Primeri komercijalne primene



Glavni računar:
- Upravljanje sistemom za detekciju defekata.
- Pregled trenutnih defekata.
- Različite statistike pojave defekata.

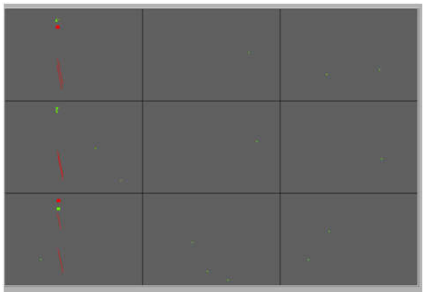


Pregled defekata na formiranoj rolni kartona.
Off Line Režim.



Statistike defekata za tekuću rolnu kartona.

Simbolički prikaz defekata za tekuću rolnu kartona.



- *LabVIEW*.
- Industrijske *firewire* kamere
- Standardni reflektori
- Upravljanje i pregled rezultata sa bilo koje lokacije u fabrici.

Iz doktorske disertacije Marka Barjaktarovića

Itasdi

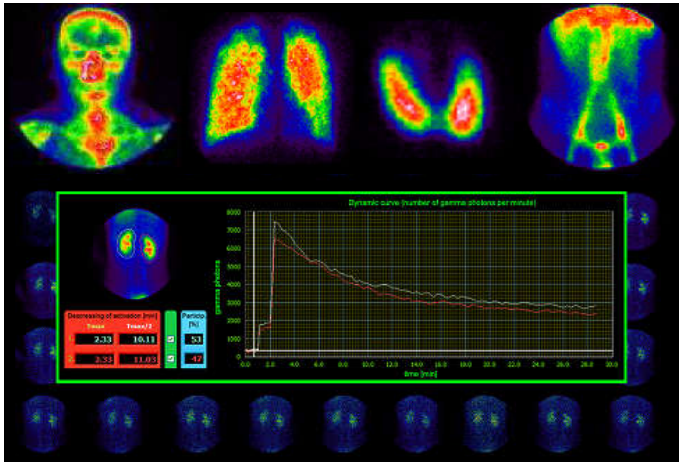
Primeri komercijalne primene

Cilj projekta: Unapređenje akvizicije, arhiviranja i obrade studija sa analognih gama kamera zamenom starih ili nefunkcionalnih računarskih sistema.

GammaKey sistem

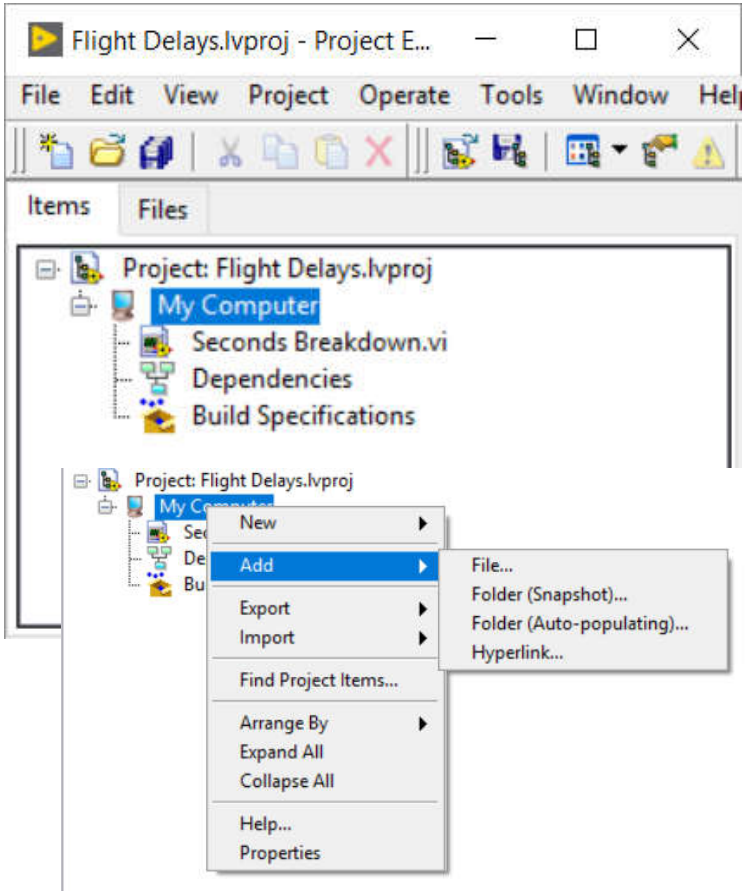
Benefit:

- Odlaganje kupovine novih skupih digitalnih gama makera i njihovih računarskih sistema
- Sprečavanje odliva medicinskog kadra u druge oblasti medicinske slike
- Naučni napredak zahvaljujući mogućnosti implementacije novih medoda u obradi slike



Iz doktorske disertacije Milice Janković

Organizacija fajlova – *Project explorer*



File>>Create Project...>>Blank Project

LabVIEW fajlovi:

- LabVIEW projekti -> .lvproj
- Virtual Instruments (VI) -> .vi

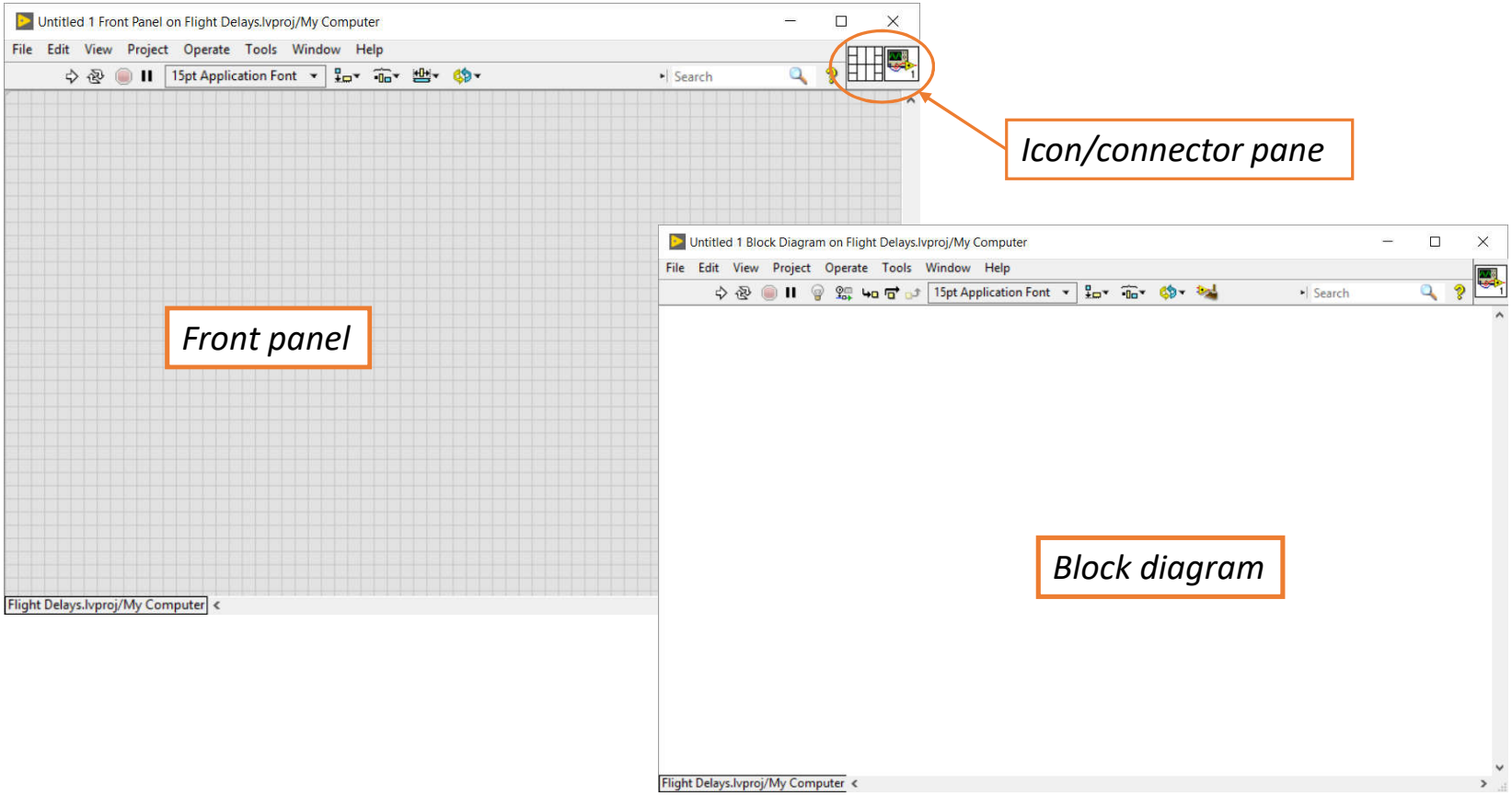
Virtual folder (Snapshot)

nije identična organizacija kao na disku

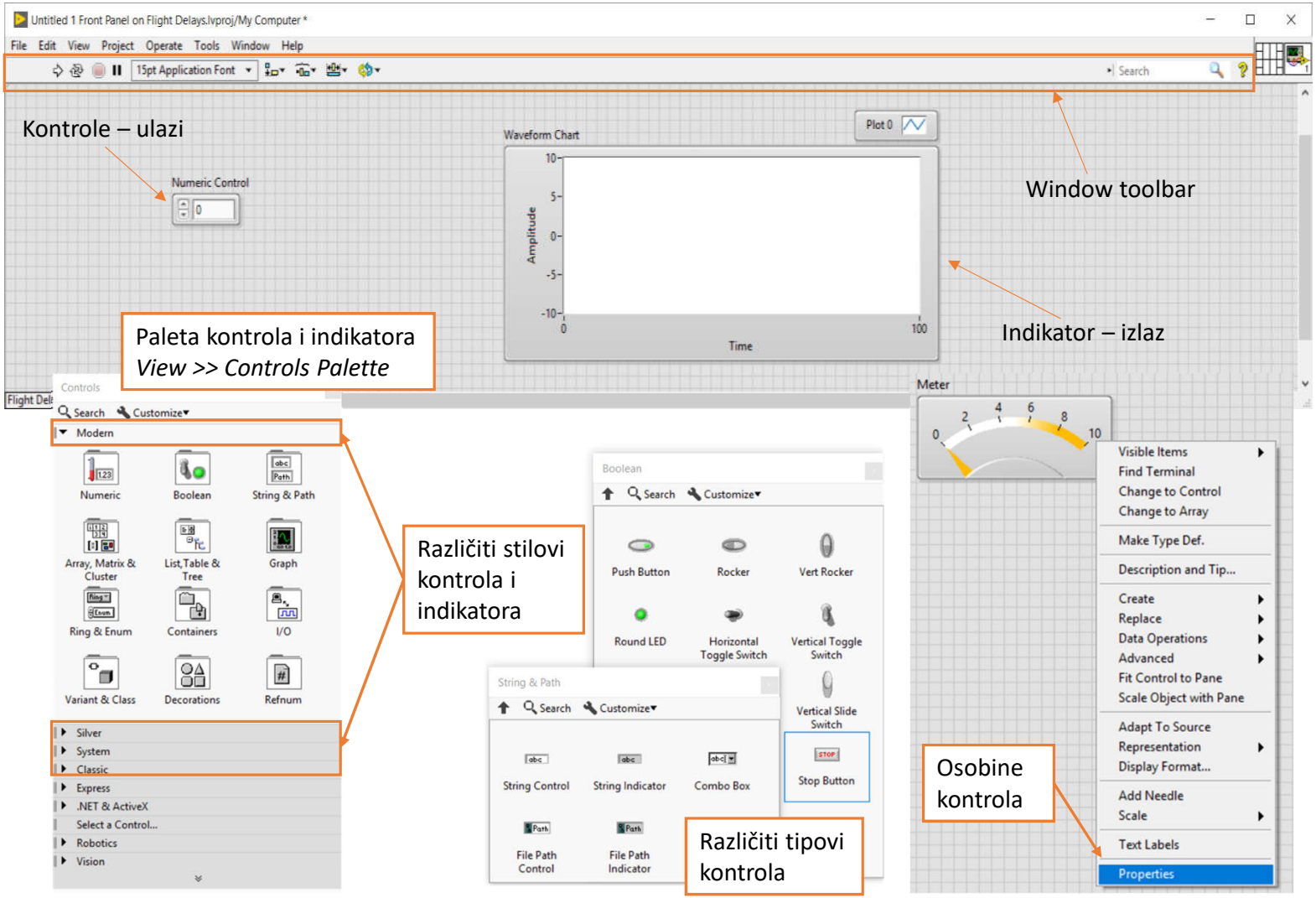
Auto-populating folder

identična organizacija kao na disku

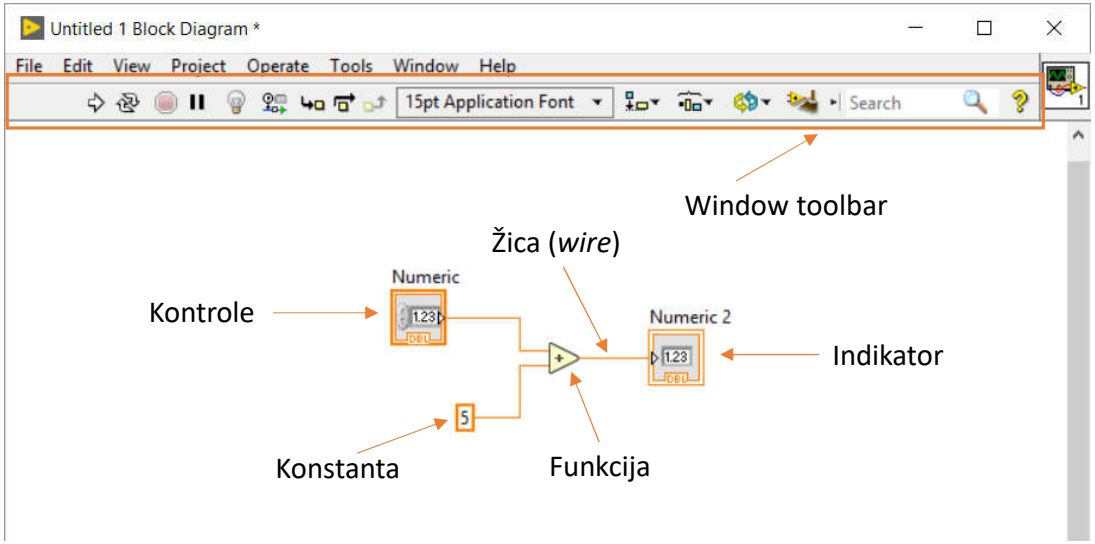
Komponente VI-a



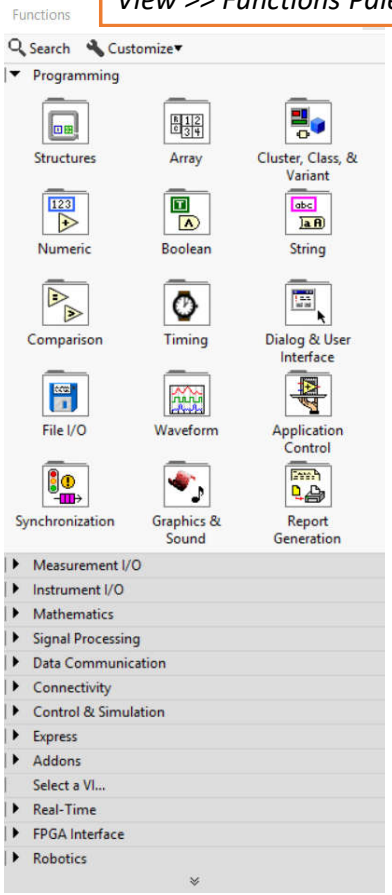
Front Panel


Untitled 1 Front Panel on Flight Delays.lvproj/My Computer *
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
Kontrole – ulazi
Numeric Control
Waveform Chart
Plot 0
Amplitude
Time
Window toolbar
Indikator – izlaz
Paleta kontrola i indikatora
View >> Controls Palette
Controls
Search Customize
Modern
Numeric
Boolean
String & Path
Array, Matrix & Cluster
List,Table & Tree
Graph
Ring & Enum
Containers
I/O
Variant & Class
Decorations
Refnum
Silver
System
Classic
Express
.NET & ActiveX
Select a Control...
Robotics
Vision
Različiti stilovi kontrola i indikatora
Boolean
Push Button
Rocker
Vert Rocker
Round LED
Horizontal Toggle Switch
Vertical Toggle Switch
Vertical Slide Switch
String & Path
String Control
String Indicator
Combo Box
Stop Button
File Path Control
File Path Indicator
Različiti tipovi kontrola
Meter
Visible Items
Find Terminal
Change to Control
Change to Array
Make Type Def.
Description and Tip...
Create
Replace
Data Operations
Advanced
Fit Control to Pane
Scale Object with Pane
Adapt To Source
Representation
Display Format...
Add Needle
Scale
Text Labels
Properties
Osobine kontrola

Block Diagram

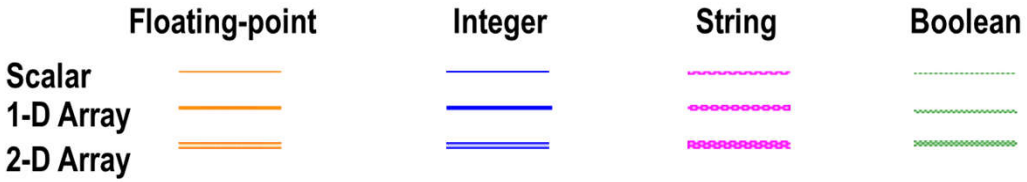


Paleta funkcija
View >> Functions Palette



Broken wire –> greška u kodu

Različitim tipovima podataka odgovaraju različite boje žice, a debljina žice odgovara dimenzijama.



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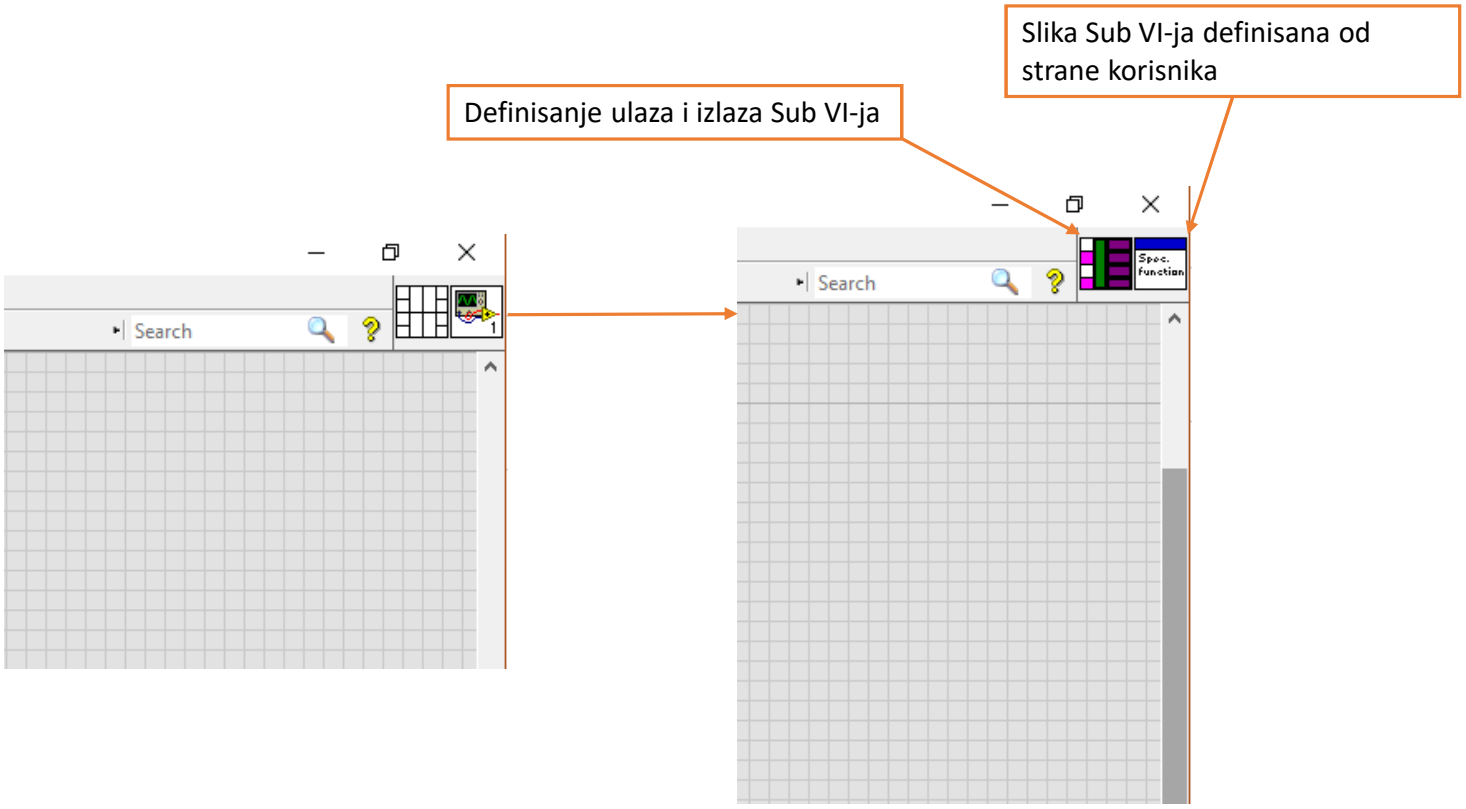
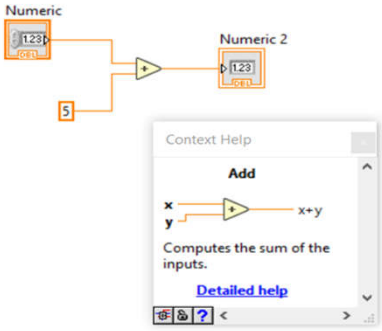
Icon/Connector pane



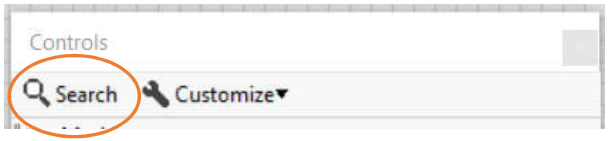
Itasdi

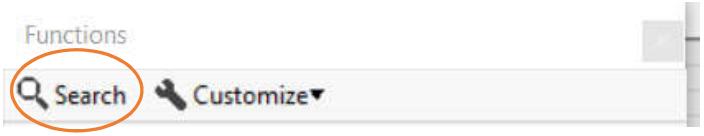
Pomoć

1. *Context Help* -> Pozicionirati se mišem iznad funkcije i pritisnuti *Ctrl + H*



2. *Help >> LabVIEW Help …*
3. *Help >> Find examples… - veliki broj primera*
4. *Controls* i *Functions Palette -> Search*





5. *Quick Drop* – poziva se pritiskom *Ctrl + Space* (brzo pronalaženje kontrola i funkcija)

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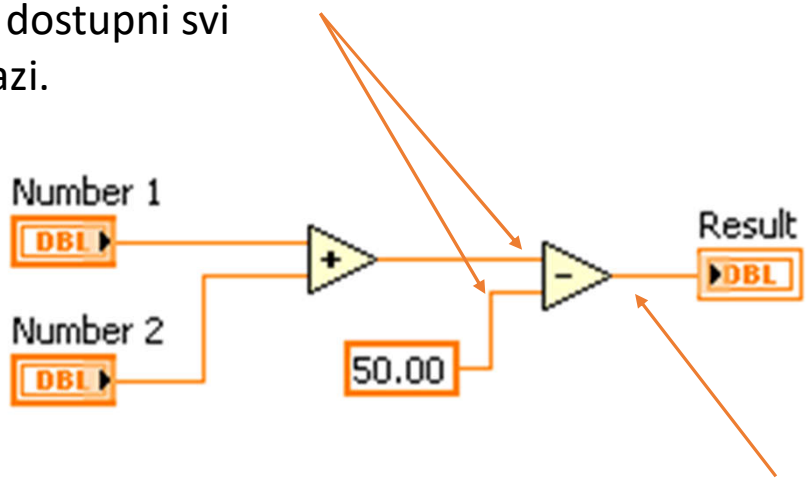
Dataflow programiranje

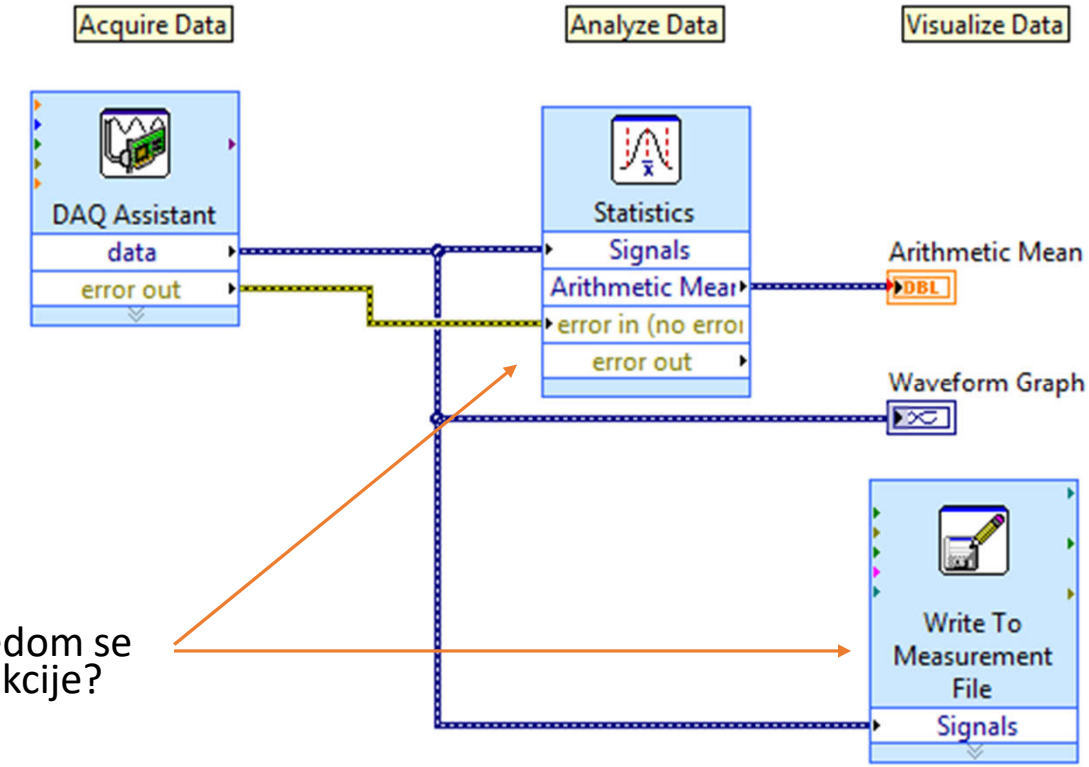
Čvor (funkcija) će se izvršiti tek kad su dostupni svi njegovi ulazi.



Čvor (funkcija) daje informacije terminalu tek kad je završio svoje izvršavanje.

Itasdi

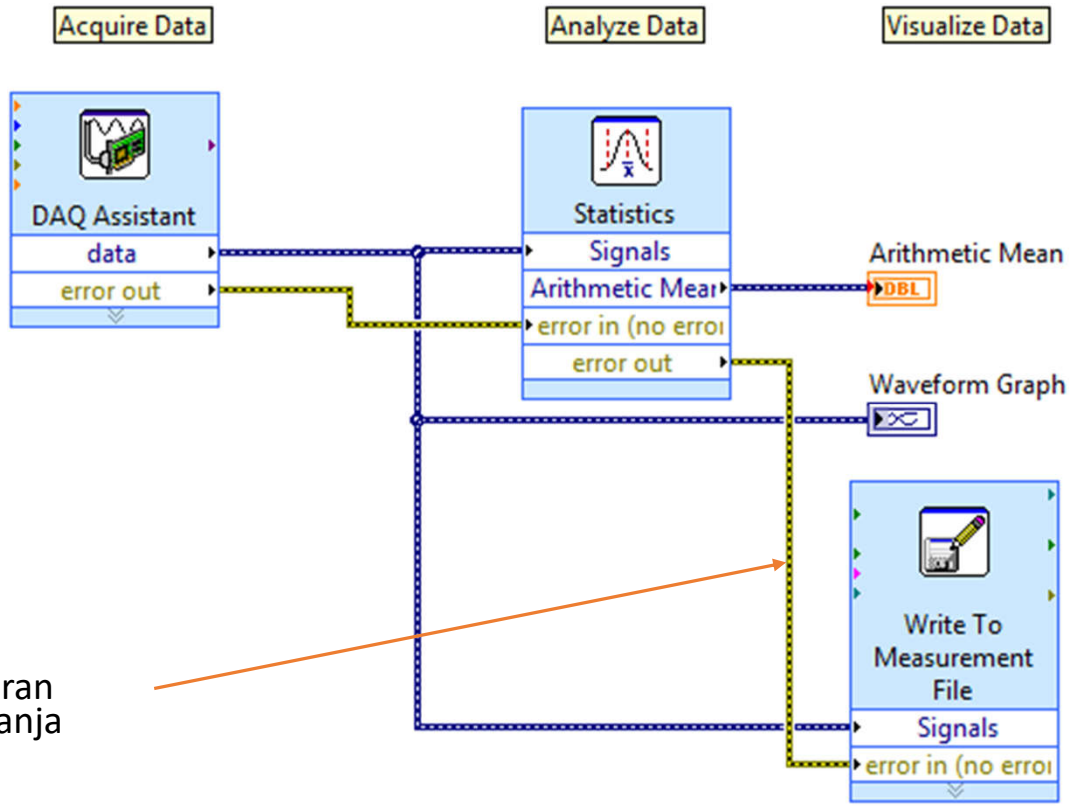
Dataflow programiranje



Kojim redosledom se izvršavaju funkcije?

Itasdi

Dataflow programiranje



Signal greške obezbeđuje siguran redosled izvršavanja

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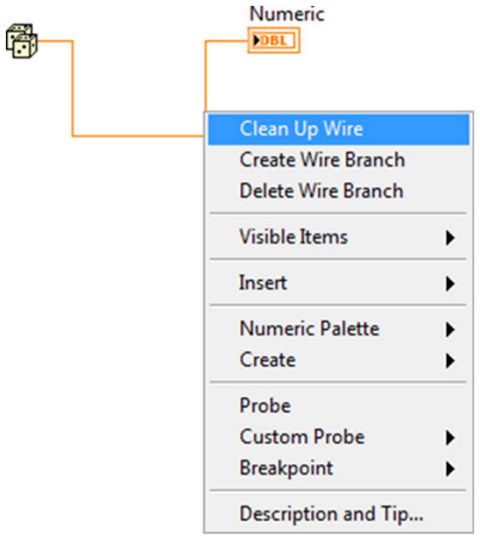
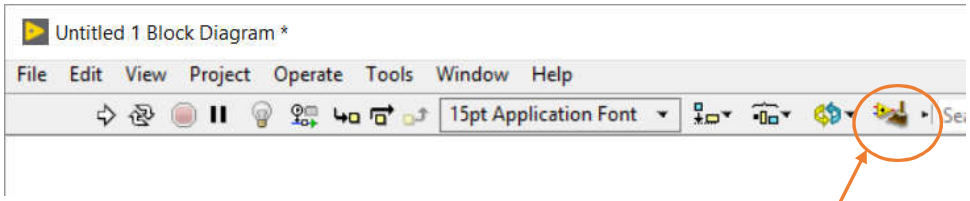
Alatke

Alatka za programiranje: Programming Tool – *View* >> *Tools Palette*

Ručni izbor alatki

Automatski izbor alatki



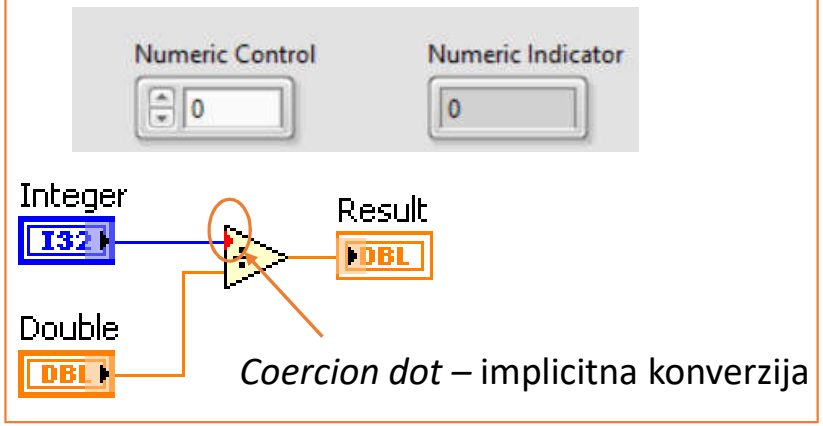


Clean up Diagram

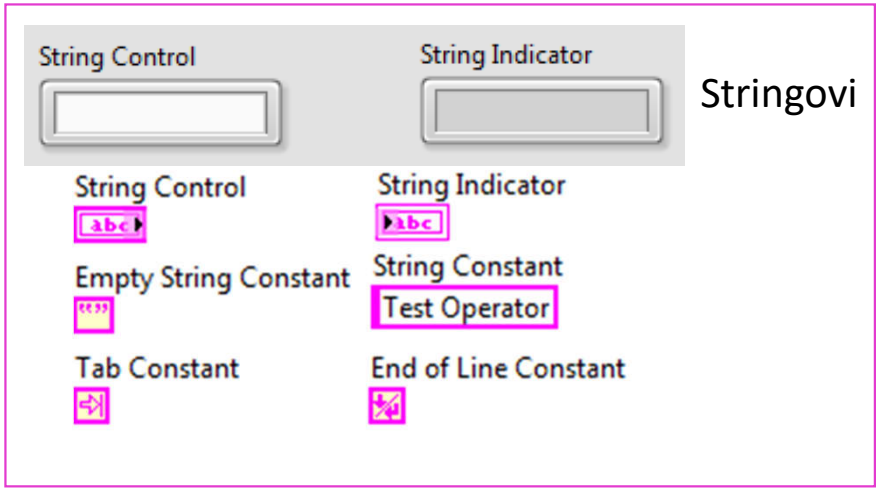
Itasdi

Tipovi podataka

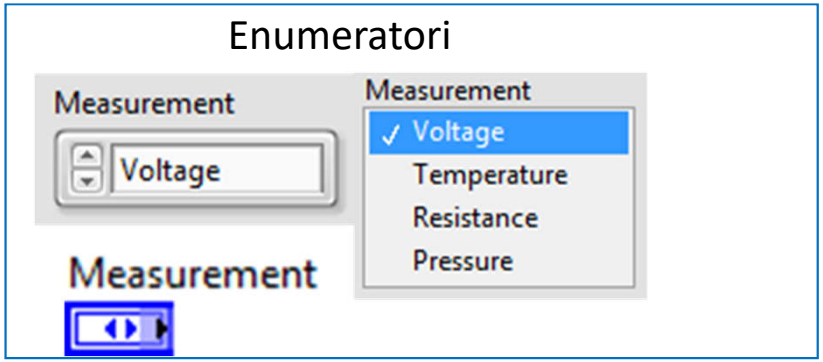
Numerički tip podataka



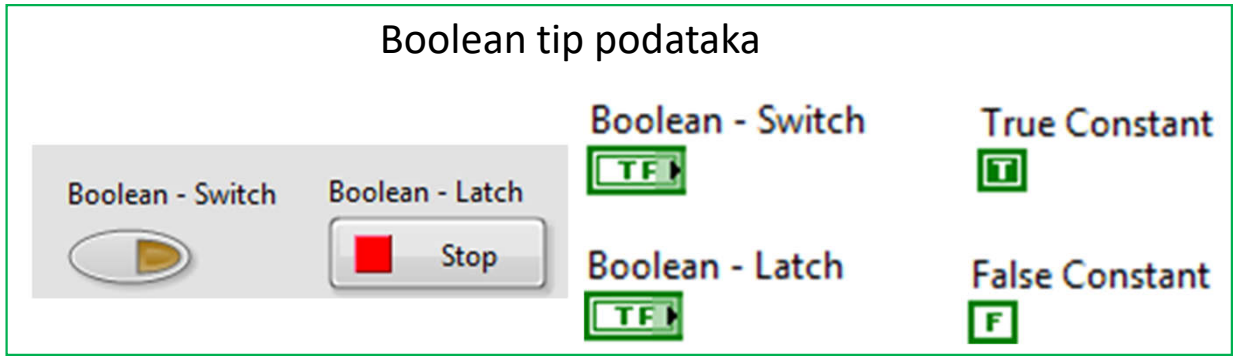
Stringovi



Enumeratori



Boolean tip podataka



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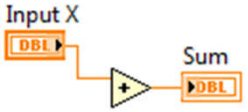
Debagovanje programa

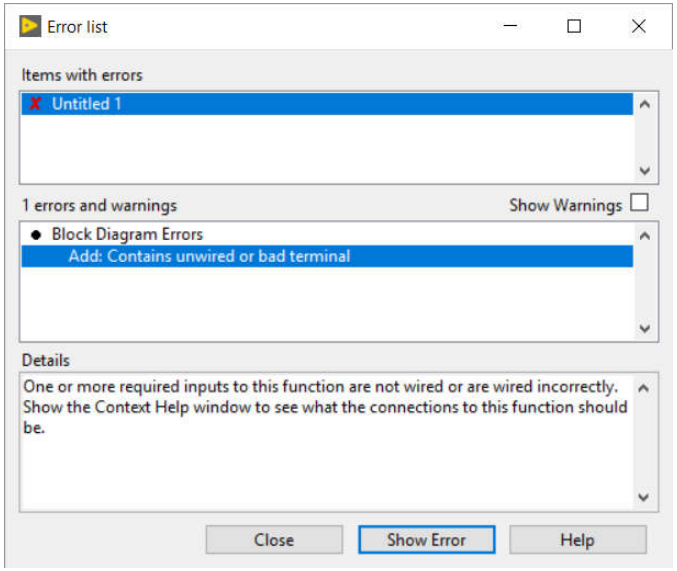
Najčešći razlozi za nemogućnost pokretanja VI-a:

- Povezivanje dva različita tipa podataka

- Povezivanje dve kontrole (ili indikatora)

- Funkcijama nisu povezani svi ulazi

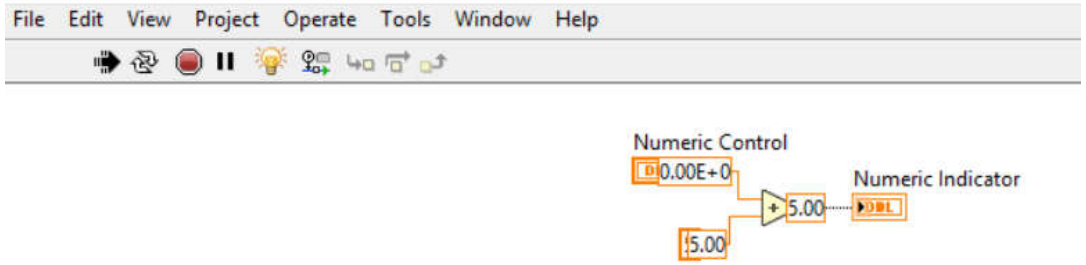




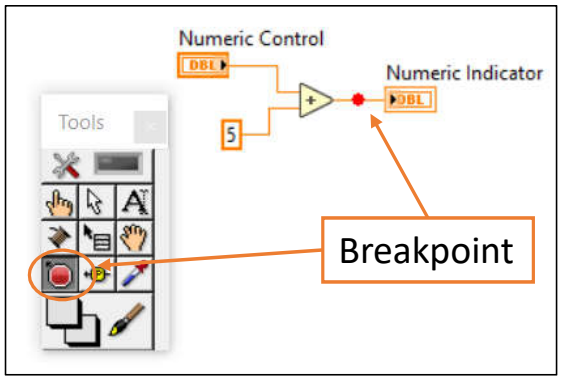
Itasdi

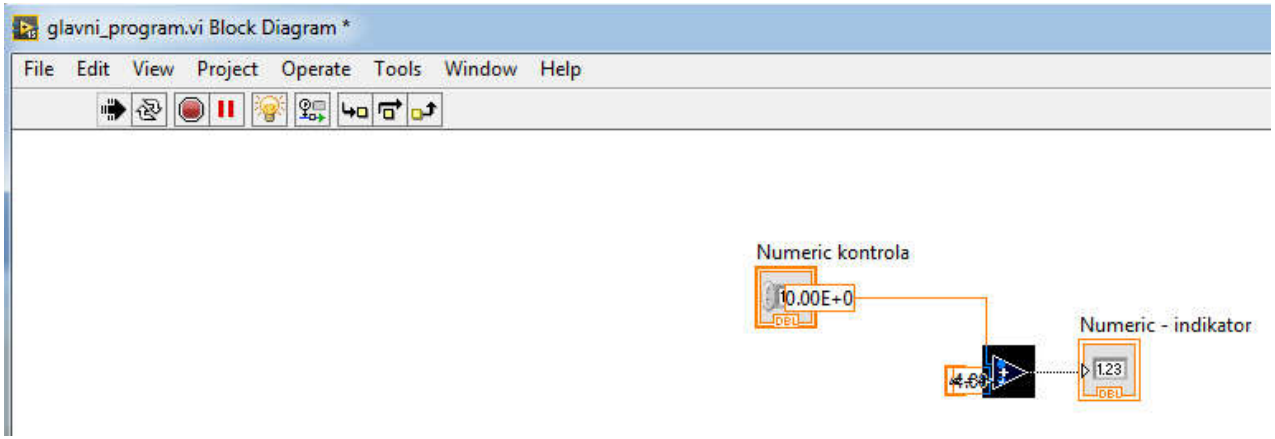
Debagovanje programa

1. *Execution Highlighting* – praćenje vrednosti u toku izvršavanja programa



2. *Breakpoint*

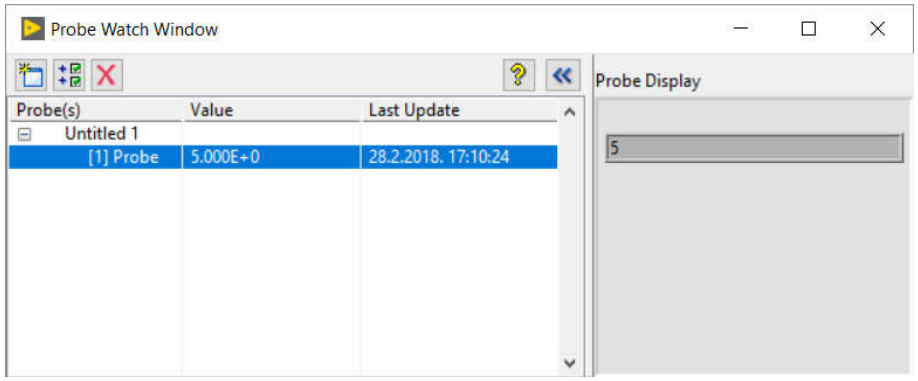




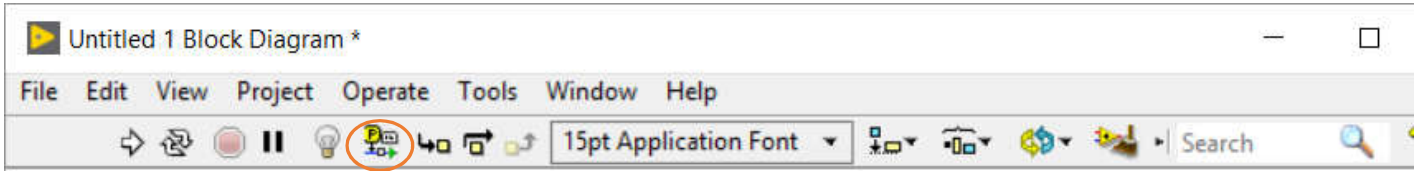
Debagovanje programa

3. Single Stepping – debagovanje korak po korak kroz funkcije

4. Probe



- *5. Retain Wire values* - ako je uključeno ostaje vrednost na "žici" nakon izvršavanja programa i može se prikazati pomoću *Probe*.



Hvala na pažnji!

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