Material taken from a National Instruments Tutorial

Introduction to LabVIEW

GRAPHICAL PROGRAMMING FOR ENGINEERS AND SCIENTISTS

6-Hour Hands-On
LabView programs are called virtual instruments because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeters.
Virtual Instrumentation Applications

• Design
  – Signal and Image Processing
  – Embedded System Programming
    • (PC, DSP, FPGA, Microcontroller)
  – Simulation and Prototyping
  – And more…

• Control
  – Automatic Controls and Dynamic Systems
  – Mechatronics and Robotics
  – And more…

• Measurements
  – Circuits and Electronics
  – Measurements and Instrumentation
  – And more…
In LabView

-- Build a user interface (front panel) with controls and indicators

-- Add the code (block diagram) using VIs and structures
LabVIEW Programs Are Called Virtual Instruments (VIs)

Each VI has 2 Windows

Front Panel
• User Interface (UI)
  – Controls = Inputs
  – Indicators = Outputs

Block Diagram
• Graphical Code
  – Data travels on wires from controls through functions to indicators
  – Blocks execute by Dataflow

ni.com
NATIONAL INSTRUMENTS
Open and Run LabVIEW

Start » All Programs » National Instruments LabVIEW

Start from a Blank VI:
New » Blank VI

or

Start from an Example:
Examples » Find Examples…
Two palettes are available
-- Controls, with the Front Panel
-- Functions, with the Block Diagram

Controls Palette
(Controls & Indicators)
(Place items on the Front Panel Window)
Control: Numeric
Indicator: Numeric Slide

Functions (and Structures) Palette
(Place items on the Block Diagram Window)
Structure: While Loop

Customize Palette View
Dataflow Programming

• Block diagram execution
  – Dependent on the flow of data
  – Block diagram does NOT execute left to right

• Node executes when data is available to ALL input terminals

• Nodes supply data to all output terminals when done
Tips for Working in LabVIEW

• Keystroke Shortcuts
  – <Ctrl+H> – Activate/Deactivate Context Help Window
  – <Ctrl+B> – Remove Broken Wires From Block Diagram
  – <Ctrl+E> – Toggle Between Front Panel and Block Diagram
  – <Ctrl+Z> – Undo (Also in Edit Menu)

• **Tools**»**Options**… – Set Preferences in LabVIEW

• VI Properties—Configure VI Appearance, Documentation, etc.
3 Types of Functions (from the Functions Palette)

Express VIs: interactive VIs with configurable dialog page (blue border)

Standard VIs: modularized VIs customized by wiring (customizable)

Functions: fundamental operating elements of LabVIEW; no front panel or block diagram (yellow)
Section II – Elements of Typical Programs

A. Loops
   • While Loop
   • For Loop

B. Functions and SubVIs
   • Types of Functions
   • Creating Custom Functions (SubVI)
   • Functions Palette & Searching

C. Decision Making and File IO
   • Case Structure
   • Select (simple If statement)
   • File I/O
Section III – Presenting your Results

A. Displaying Data on the Front Panel
   • Controls and Indicators
   • Graphs and Charts
   • Loop Timing

B. Signal Processing
   • MathScript
   • Arrays
   • Clusters
   • Waveforms
**How Do I Time a Loop?**

1. **Loop Time Delay**
   - Configure the Time Delay Express VI for seconds to wait each iteration of the loop (works on For and While loops).

2. **Timed Loops**
   - Configure special timed While loop for desired $dt$. 

![Diagram of Time Delay and Timed Loop](image)
LabVIEW Functions and SubVIs operate like Functions in other languages

**Function Pseudo Code**
function average (in1, in2, out)
{
    out = (in1 + in2)/2.0;
}

**Calling Program Pseudo Code**
main
{
    average (in1, in2, pointavg)
}

**SubVI Block Diagram**

**Calling VI Block Diagram**
Example of a signal display