ME 224: EXPERIMENTAL ENGINEERING

Class: M 1:00-1:50  TECH: L170
Labs: T and Th 2:00-4:50 PM
Ford Building : B100

Lecture 2
Introduction to Labview

- **Labview (Laboratory Virtual Instruments Engineering Workbench)**
- Made by National Instrument (http://www.ni.com/labview/)
- Graphical programming development environment
- Labview programs called virtual instruments (VI)
- Data acquisition and control, data analysis, and data presentation

Reference Book (Recommended):

Labview Programming Environment

Startup Screen

Quick Tip:
To list multiple file types in a File dialog box, wire a string constant or control into the file pattern terminal separated by a semicolon (fx*.bin; *.c).

Small Dialog Large Dialog
Front Panel

Block Diagram
Front Panel
The front panel is the user interface of the VI. You build the front panel with controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls are knobs, pushbuttons, dials, and other input devices. Indicators are graphs, LEDs, and other displays. Controls simulate instrument input devices and supply data to the block diagram of the VI. Indicators simulate instrument output devices and display data the block diagram acquires or generates.

The Control palette is available only when the front panel window is active.
Block Diagram

After you build the front panel, you add code using graphical representations of functions to control the front panel objects. The block diagram contains this graphical source code. Front panel objects appear as terminals on the block diagram. Additionally, the block diagram contains functions and structures from built-in LabVIEW VI libraries. Wires connect each of the nodes on the block diagram, including control and indicator terminals, functions, and structures.

The Function palette is available only when the block diagram window is active.
Tools Palette

The **Tools** palette is available on the front panel and the block diagram. A tool is a special operating mode of the mouse cursor. When you select a tool, the cursor icon changes to the tool icon. Use the tools to operate and modify front panel and block diagram objects. Select **Window»Show Tools Palette** to display the **Tools** palette. You can place the **Tools** palette anywhere on the screen. If automatic tool selection is enabled and you move the cursor over objects on the front panel or block diagram, LabVIEW automatically selects the corresponding tool from the **Tools** palette.
Some Important Tool Functions

**Wiring tool:** Tool to define data paths between terminals.

**Operating tool:** Tool to enter data into controls and operate them.

**Labeling tool:** Tool to create labels and enter text into text windows.

**BreakPoint Tool:** Use the Breakpoint tool to place a breakpoint on a VI, node, or wire on the block diagram and pause execution at that location. When you set a breakpoint on a wire, execution pauses after data pass through the wire. Place a breakpoint on the block diagram workspace to pause execution after all nodes on the block diagram execute.

**Positioning Tool:** Used to position objects. The Positioning tool also resizes objects. To avoid resizing an object, place the Positioning tool in the center of the object to move it. Click the corners of an object to resize it.

**Scrolling tool:** Used to size window for VIs.
Control Palette

The Control palette is available only when the front panel window is active.
Numerical Control

- Digital Control
- Vertical Fill slide
- Horizontal Fill Slide
- Knob
- Tank

Control - Input

Indicator - Output

Digital Indicator
Vertical Pointer Slide
Vertical Graduated bar
Gauge
Thermometer
Boolean Control

- Push Button
- Round LED
- Square LED
- Vert Rocker
- Vertical Toggle switch
- Vertical Slide Switch
Graph Control

Waveform Chart

Intensity Chart

3-D Surface Graph

XY Graph

Digital Waveform Chart

3-D Curve Graph
The Function palette is available only when the block diagram window is active.
Numeric Function

- Compound Arithmetic
- Conversion
- Trigonometric
- Add
- Increment
- Absolute Value
- Square root
- Numeric constant
- Numeric Function
- Trigonometric
Boolean Function

AND
NOT AND
AND ARRAY ELEMENTS
TRUE CONSTANT
COMPOUND ARITHMETIC
AND
BOOLEAN TO 0 or 1
FALSE CONSTANT
Example: Calculator (Add): \( C = A + B \)
Structure

- **Sequence** -- Execute sub-diagrams sequentially
- **For loop** -- Repeat a certain operation until a specified number of iteration is completes
- **While** -- Repeat a section of code until a certain condition is met
- **Case** – Selection of execution of events
- **Formula Node** – Program one or more algebra formula using a syntax similar to most text-based programming language
Example: Lab #2 activities 5

Task: Build the circuit below and make the Labview program to acquire the 25 readings from the potentiometer and send them to a file to be later analyzed using Excel.

Procedure

1) How to acquire the data from PC?
   Using Data Acquisition Board (DAQ)- analog signal to digital signal conversion (ADC)

3) How to control the reading of one data?
   Using a button switch, Press a button, get one reading. After the button is released, no reading.

5) How to control the reading of 25 data?
   by using “For loop”

4) How to write to a txt file? Using “File I/O” function
Data Flow Chart

Start

i = 0, N = 25

button pressed?

No

Yes

i = i + 1

Get data from port 0 (ADC)

Convert digital signal to actual numerical value of voltage

Put the data into buffer

Is i > N?

No

Yes

Save the data to file

End
Labview Program

For loop

While loop

Sequence

Frame 0

Frame 1

Get Reading

Frame 1

ADC

Formula Node

Front panel

Get Reading

Numeric

0

Front panel

Get Reading

Numeric

0
File I/O: Input and output data from files

Write To Spreadsheet File

Converts a 2D or 1D array of single-precision (SGL) numbers to a text string and writes the string to a new byte stream file or appends the string to an existing file.

Not sure what each terminal means? Online Help can help