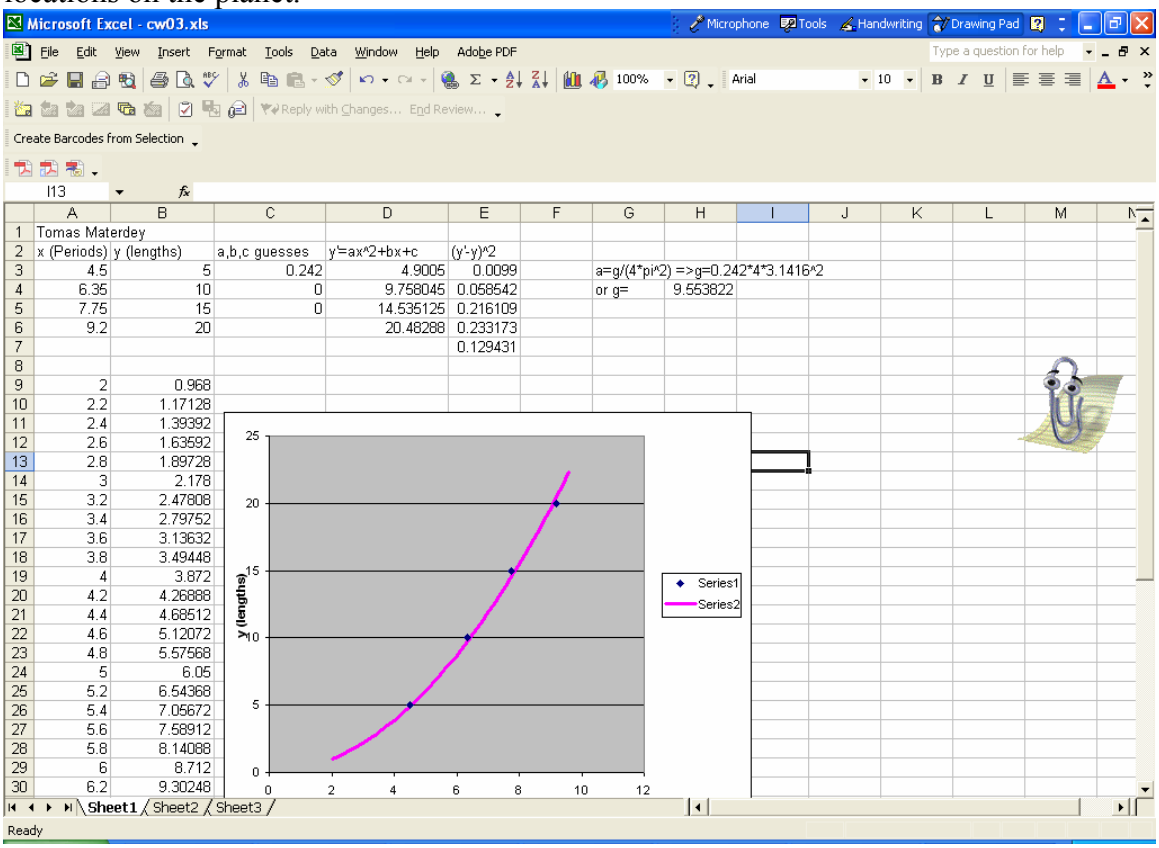
Engin 103
Fall '06
Meeting #14: October 17, 2006

Connection between the data modeling we did with physics:

The period of an ideal pendulum (mass of string is negligible, bob is not so large, no friction involved) is given by

$$T = 2\pi\sqrt{\frac{L}{g}} \qquad \text{or} \qquad L = \frac{gT^2}{4\pi^2}$$

To test how ideal is our pendulum (represented by the 4 pairs of data we used in CW#3), let do a quadratic curve-fitting by setting b=c=0 and letting the coefficient a change so as to minimize the standard deviation, **check how well the final value for a agrees with g=9.81m/s^2.** This method can be used to calculate the constant of gravity at different locations on the planet.



Does the model you found for your particular device apply to another device?

No, the models are device-specific, since it was obtained using a specific set of data associated with a specific device. If getting a different device, new data need to be measured and the curve-fitting needs to be redone.

What is the difference between science and engineering?

Science extracts the simplicity and universality that are behind a wide range of devices or situations by ignoring many specific factors such as frictions, fluid motions, etc. Engineering includes more parameters into a model that produces excellent predictions, but that is only valid for that particular device.

Engineering design

We talked about the engineering design process, whose starting point is the client who defined the specifications that include costs and times, and existing codes. The design is geared toward satisfy the specifications, or the client, as well as existing safety standards and other regulations. The specifications for Engin 103 projects are posted on the e-syllabus. Once the specifications are defined, the subsequent phases will come into play such as: brainstorming, research, prototype, improvements, documentation, etc.

As an example of satisfying the specifications we did CW#2 on answering "Why not making a shorter vehicle?" based on reading section 2.5 of the Design Concepts for Engineers book.

Other design related questions are HW#1 questions 1-3. The answers to these questions should include a computer drawing (using Paint) explaining the conceptual designs.

LabVIEW:

-LabVIEW: background for HW1 questions 4 and 5. **How to locate different functions within the Front Panel** (user interface: inputs and outputs quantities) **and within the Block Diagram** (programmer interface: operations, analysis).

-Things belonging to the Front Panel will be found under **Controls palette**, abbreviation is C, which can be brought up by 'right-clicking' (click on the mouse's right button) on the Front Panel.

-Things belonging to the Block Diagram will be found under **Functions palette**, abbreviation is F, which can be brought up by 'right-clicking' on the Block Diagram.

-Things to operate VI (Virtual Instruments) will be found under **Tools palette**, abbreviation is T, which can be brought up by clicking on Window, then select 'Show Tools Palette'

For example, where to locate 'Array'?. We start by guessing whether this is an input/output or an operation, it is more of a numeric input utility, so right-click on the Front Panel to bring up the Controls palette (C), then select subpalette All Controls, then select subpalette Array and Cluster, to find Array in the first button. So the complete location for Array reads C/All Controls/Array and Cluster.

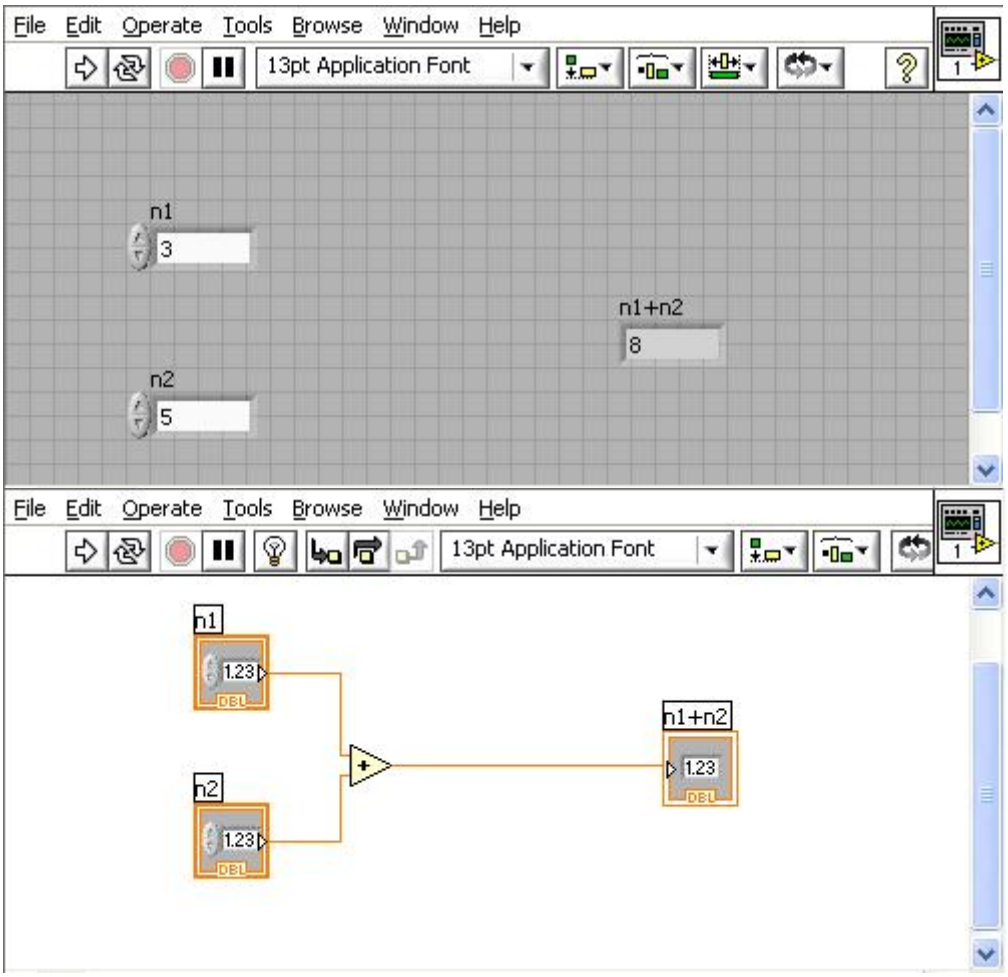
For example where to locate ‘Reciprocal’?. This is more of an operation (getting the reciprocal of x is doing 1/x). So right-click on the Block Diagram to bring up the Functions palette (F), then select All Functions, then Numeric, and find Reciprocal under button 1/x. So the location for Reciprocal is F/All Functions/Numeric

-As a background to changing values on a Numeric Control, we make a simple addition VI. We will need two inputs (Numeric Controls) and one output (Numeric Indicator) in the Front Panel, where the user will input the numbers she/he would like to add, where she/he will read the result, respectively. We should label the inputs as n1 and n2, and the output as n1+n2. This is necessary to identify identical elements on the Block Diagram, and as part of the user interface. **Label** can be entered by typing into the blank box that is shown when an element is placed in the Front Panel. The blank box can be brought up by right-click on the element and select ‘**Show Label’**. To edit labels, select the Text tool, under Tools Palette, then click on the label.

To tell LabVIEW how to produce the output from these inputs, the programmer goes to the Block Diagram to place the addition operation (F/All Functions/Numeric), then wire the inputs n1 and n2 into the left terminals of the addition by selecting the **wiring too**l (under T), click to start, click to end, double-click to finish a wiring. Note that since the addition is commutative, n1 and n2 can be individually connected to either the left upper terminal or the left lower terminal of the addition operator. Should we have a division, the upper terminal is divided by the lower terminal, or the left terminals are different. In a subtraction, the upper terminal is subtracted by the lower one.

If we need to remove any piece of wire, use the **Select tool** (arrow under T) to select that piece, then hit ‘backspace’ on the keyboard.

Then it comes to put in values into the Numeric Controls to test our addition VI: using the **Operate Value tool** (finger, under T) and click on the left handles to increase or decrease by an integer unit. To run the VI, click on the **Run button** (right arrow in the upper left corner), the results should show as expected. If we would like to scan through different inputs and outputs without having to hit the Run button every time we change the inputs, then use **Run Continuously** (found to the right of the Run button). Under this mode, the VI should be stopped before any modification can be made.



Suggested items to write in the Engin 103 logbook:

1) **Identify different components in an engineering design process (mentioned in this note) as experienced in Projects 0 and 1 you have just done in this course.**
2) **What is a VI? How to locate the Control Palette, the Functions Palette, the Tools Palette**

Items due next class:
-HW1