PTC Technical Specialists E-Newsletter

Date: March 2009

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PTC Product Focus

Using Mathcad Scriptable Controls to Enhance the Calculation Process

With Scriptable Controls in Mathcad, engineers have the flexibility to program the behavior of specific objects. Often it is desirable to augment the calculations in a Mathcad worksheet with additional control over how input variables are handled or how results are presented. It may also be necessary to have an interface to back-end scripts in order to leverage the additional functionality available within the runtime environment. Mathcad's Scriptable Controls provide users with a collection of objects that can be customized to meet particular requirements and improve the overall calculation process.

Mathcad's Scriptable Controls collection consists of six programmable items. Note that these Scriptable Controls are different from Mathcad's Web Controls, which are standard input controls quite similar to those seen on HTML forms. Unlike Scriptable Controls, Mathcad's Web Controls are out-of-the-box input mechanisms and used primarily for input variable selection.

Scriptable Controls truly enhance engineers' ability to tailor their worksheets and produce high quality Mathcad documents that adhere to their engineering calculation processes. They are completely interactive and follow Mathcad's general processing sequence. Each of these controls is discussed briefly in the following sections.

Slider Control

The Slider Control provides a visual approach to setting a variable. The start value, end value, and interval on the slider are configurable. The location of the selection bar determines the value of the slider output, which then populates a variable to be used in subsequent calculations.

---

slope :=

Slider value of -6 is selected, which sets the slope of the line used in the plot.

Straight Line with y-intercept at 5 and slope of -3
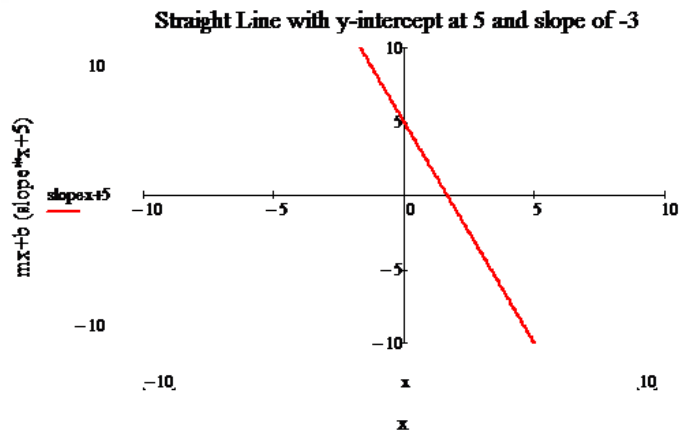
List Box Control

The List Box Control provides the user with a list of choices from which to make a selection. This is especially useful when selecting from materials or parts lists. The advantage of the Scriptable List Box in such cases where a material or part is being selected is that the script can return (i.e. the output of the list box control) a complete set of properties or sub-types for the chosen material/part. Those properties can then be used to pre-populate another list box (i.e. inputs to a second list box control), and so on.
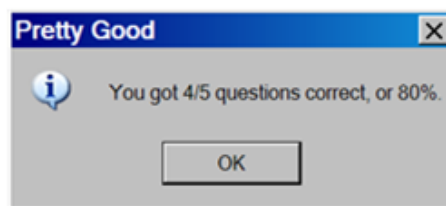
Button Control

The Button Control has many applications. Buttons in Mathcad can be scripted to perform a variety of tasks. The button is configured with its inputs from the worksheet. In the script, the button can perform some type of check to ensure the inputs satisfy the input variable requirements and return an appropriate message to the user, either via an output variable or perhaps a pop-up dialog. Another possibility could be a scenario where the button invokes some other application or executable with the given inputs. Conveniently, the script behind a scriptable button has access to the xml content for the entire file. This facilitates a somewhat tricky yet incredibly useful method where the script can overwrite a portion of the file's xml based on the inputs in real time.

$$student := (1 \quad 2 \quad 4 \quad 2 \quad 3)$$

$$teacher := (1 \quad 2 \quad 4 \quad 2 \quad 2)$$

Grade Test

$$\left(student^T \quad teacher^T \right)$$

Pretty Good

ⓘ You got 4/5 questions correct, or 80%.

OK

"Grade Test" Button uses the "student" and "teacher" vectors to compute the test score and communicate the result using a message box.

Check Box Control

The Check Box Control is a simple checkbox that is either checked or unchecked. If unchecked, the output of the control is zero. If checked, the output is one. The output variable can then be used in equations directly or indirectly.

$\text{nonlin} :=$

☑ Uncheck this box to include only linear terms.

$\text{nonlin} = 1$

$f(x) := x + 5 + \text{nonlin} \cdot x^2$ $\qquad f(32) = 1.061 \times 10^3$

Radio Button Control

The Radio Button Control provides a group of choices from which to define a variable. The output of the control identifies which item from the group is selected. The script for the Scriptable Radio Button is the same for every item in the group and may include custom logic for each item in the group.

Text Box Control

The Scriptable Text Box Control starts off as an empty textbox. The input to the text box control is used in the script that runs when the text box executes in the worksheet. The output of the control sets the contents of the text box. Scriptable Text Boxes have numerous uses. For example, a text box might be scripted to perform some error checking on a critical result. It is rather common for Scriptable Text Boxes to utilize system commands as part of the process.

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Script retrieves date and time stamp from system clock and populates the text box.

Detailed documentation on Mathcad Scriptable Controls can be found in the **Developer's Reference** in Mathcad Help.

For more information on Mathcad, the global standard for engineering calculations, please visit our website: http://www.ptc.com/products/mathcad/.

The examples used to support this discussion are taken from the Mathcad 14 Resource Center: Mathcad 14 →Mathcad Resources: Mathsoft Controls.

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PTC Product Focus

Windchill Work Packages

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Tips of the Month

Using Mathcad's Scriptable Text Box Control to Validate a Result

Engineering design calculations must be accurate and error free. When performing calculations in Mathcad, it is always helpful to add color to the worksheet to visually identify critical design parameters, equations, and results. Math regions containing such variables and results can easily be highlighted by accessing the properties panel for the region and enabling the *Highlight Region* option on the Display tab.

To take the concept of color one step further, consider the benefits of being able to color code a critical result according to whether or not it passes some error check criteria. The ability to "red flag" a result if it does not satisfy design requirements at the time the error is made could conceivably eliminate many mistakes from moving forward undetected. Mathcad's Scriptable Text Boxes make it possible to incorporate error checking into the calculation process. Intermediate checks can be implemented throughout the worksheet and critical results can be validated before they are used in the next phase of development.

Adding a Scriptable Text Box to a Mathcad Worksheet

1. From the **Insert** menu, select Insert→Control→Textbox.

2. Enter a dummy variable into the variable placeholder (this is used for counting purposes). Right-click the textbox and select *Add Input Variable*. Enter a variable from the Mathcad file whose value will be checked.

$$count :=$$

$$y$$

In this case, *y* is a result from the Mathcad file that will be validated to make sure it is not out of range, and *count* is the dummy variable.

3. Right-click the textbox and select *Edit Script*. Mathcad will open a scripting window with the framework already in place. Add code that <u>performs the error check, populates the textbox with the desired text output</u> (for instance, the output could simply repost the input which in this case would be the value of *y,* or the output could be a string that communicates status such as *Pass/Fail)*, and <u>sets the background color</u> – this is the important part!

4. **Save** and **Close** the scripting window.

5. Modify variables in the worksheet that will cause the error checking to pass/fail. Observe the textbox change colors to reflect the error checking logic.

The example script below will set the background color of the textbox to red if the input variable has a value greater than one hundred. Similarly, it will set the background color to blue if the value of the input is less than or equal to one hundred. It also sets the output of the textbox equal to the input. Note that the background color should be set in hexadecimal format.

```
Sub TextBoxEvent_Start()
   Rem TODO: Add your code here
End Sub
Sub TextBoxEvent_Exec(Inputs,Outputs)
   If CDbl(Inputs(0).Value) > 100 Then
           TextBox.BackColor = &H0000CF&
     Else
           TextBox.BackColor = &HCF000F&
   End If
TextBox.Text = Inputs(0).value
End Sub
Sub TextBoxEvent_Stop()
   Rem TODO: Add your code here
End Sub
```

The example script above produces the following color coded result in a Mathcad worksheet where the *y* variable being checked satisfies the design constraints:

$$f(x) := \sqrt{x^3 \cdot 2\pi} \qquad y := f(3) \qquad y = 13.025$$

Red background if over 100   13.0248225820
Blue background if under 100

When *y* is not within the design constraints (i.e. over 100), the example script produces a red background:

$$f(x) := \sqrt{x^3 \cdot 2\pi} \qquad y := f(50) \qquad y = 886.227$$

Red background if over 100   886.226925452
Blue background if under 100

For additional examples on Scriptable Text Boxes in Mathcad, please refer to the *Programming* and *Using Mathcad With Other Applications* sections of the **Quicksheets** in Mathcad Help.

Tips of the Month

Creating a Windchill Work Package

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Announcements

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    - Simulation/Analysis
    - Production
    - Design Collaboration

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- Windchill ProjectLink

- Pro/INTRALINK

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E-PROFILES IS HERE!!

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Please take a few minutes to check out this new web site. We don't think you will be disappointed.

http://profilesmagazine.com/

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Upcoming Events & Training Class Schedules

Upcoming, 2009   Your local Pro/Engineer User Groups
                            http://www.ptcuser.org/rugs/

June 7 – 10, 2009   Orlando, FL USA
                            PTC/USER World Event
                            http://www.ptcuser.org/

Events

Our seminars and conferences seek to provide you with relevant information regarding product development trends in your industry as well as innovative software learning experiences. Think of them as a constructive day off where you can share experiences and swap ideas with your peers.

If you can't manage to get away, we'll bring it to you. Check back often for regularly scheduled live webcast events.

You're Invited to Attend…

Please visit the PTC Education Services website for the latest training information including course descriptions, schedules, locations, and pricing.

- Attend a course at any PTC Center and receive a free copy of Pro/ENGINEER Wildfire Student Edition!

    http://www.ptc.com/services/edserv/index.htm

Live Instructor-Lead Virtual PTC Training Courses

Virtual Classrooms provide interactive learning with a trained PTC instructor in convenient and manageable sessions that last approximately 4 hours over a series of days. It's easy to join a class right from your desk using a phone or voice-over IP technology.

Sessions are performed just like a traditional ILT (including interactive exercises where you and the instructor can work on lab exercises together) and feature some of our most popular ILT courses. These sessions cover the exact same material as the traditional ILT in-center courses. Also look for some of our most frequently requested mini-topics delivered in the same format that are only an hour - two hours in duration.

If you have any questions about these sessions or would like to see getting other courses, not on this list, on the schedule please feel free to contact me for more details. They are a great way to bring training to you without you having to worry about location or being out from work for long stretches.

You can register for these sessions just as you would for any normal ILT class either by:

1. calling order admin at http://www.ptc.com/services/edserv/training/registra.htm or

2. you can go to PTC University directly at http://www.ptc.com/learning and submit a registration request directly. All you have to do is search the catalog by typing in "virtual" in the search field and you will see a listing.

PTC

Note: This PTC E-Newsletter will continue to be used for the following:

1) Inform you on events related to PTC products (user groups, conferences, training schedules, etc.)

2) Educate you on solutions that are available at PTC

3) Tips & Techniques using PTC Products

Note: These messages are compiled in the local PTC office and will be distributed via e-mail.

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