PTC Technical Specialists E-Newsletter

Date: March 1, 2007

PTC Product Focus

Using Pro/ENGINEER and Mathcad to Work Smarter

With this release of Pro/ENGINEER Wildfire 3.0 M030, PTC is introducing the first formal integration between Mathcad -- PTC's engineering calculation software - and Pro/ENGINEER -- PTC's integrated CAD/CAM/CAE software. This integration allows customers to associate Mathcad files with Pro/ENGINEER parts and assemblies, enabling unique predictive engineering capabilities.

How does this release help customers?

The combined strengths of Pro/ENGINEER and Mathcad deliver an integral solution that enables companies to automate the process of leveraging critical engineering calculations to drive product design models.

This integration improves productivity and design quality by enabling users to reduce errors from manually transferring dimensions and parameters between files, reduce time needed to update changes to parameters, verify that correct versions of the files are being used, and perform what-if analyses and instantly visualize results.

What is predictive engineering?

"Predictive engineering" is a product development process capability enabled by using Mathcad early in the product design and development process. Mathcad can be used to apply scientific and mathematical principles to engineering design problems at the beginning of the design process in order to determine the critical dimensions and parameters used downstream in the CAD model. By calculating the parameters required and "predicting" the performance of the design up front, instead of guessing key dimensions and parameters, product designers can produce an optimized design more rapidly and with less iteration than the traditional methods used today.

The integration between Pro/ENGINEER and Mathcad is a bi-directional link between the two applications. Users can easily associate any Mathcad file with a Pro/ENGINEER part or assembly using the Analysis feature in Pro/ENGINEER. Critical values calculated in Mathcad can be mapped to parameters and dimensions in the CAD model to drive the geometric design. Parameters from a Pro/ENGINEER model can also be input into Mathcad for downstream engineering design calculations. The integration offers dynamic updates to calculations and the CAD drawing when parameters are changed.

Which specific builds are integrated?

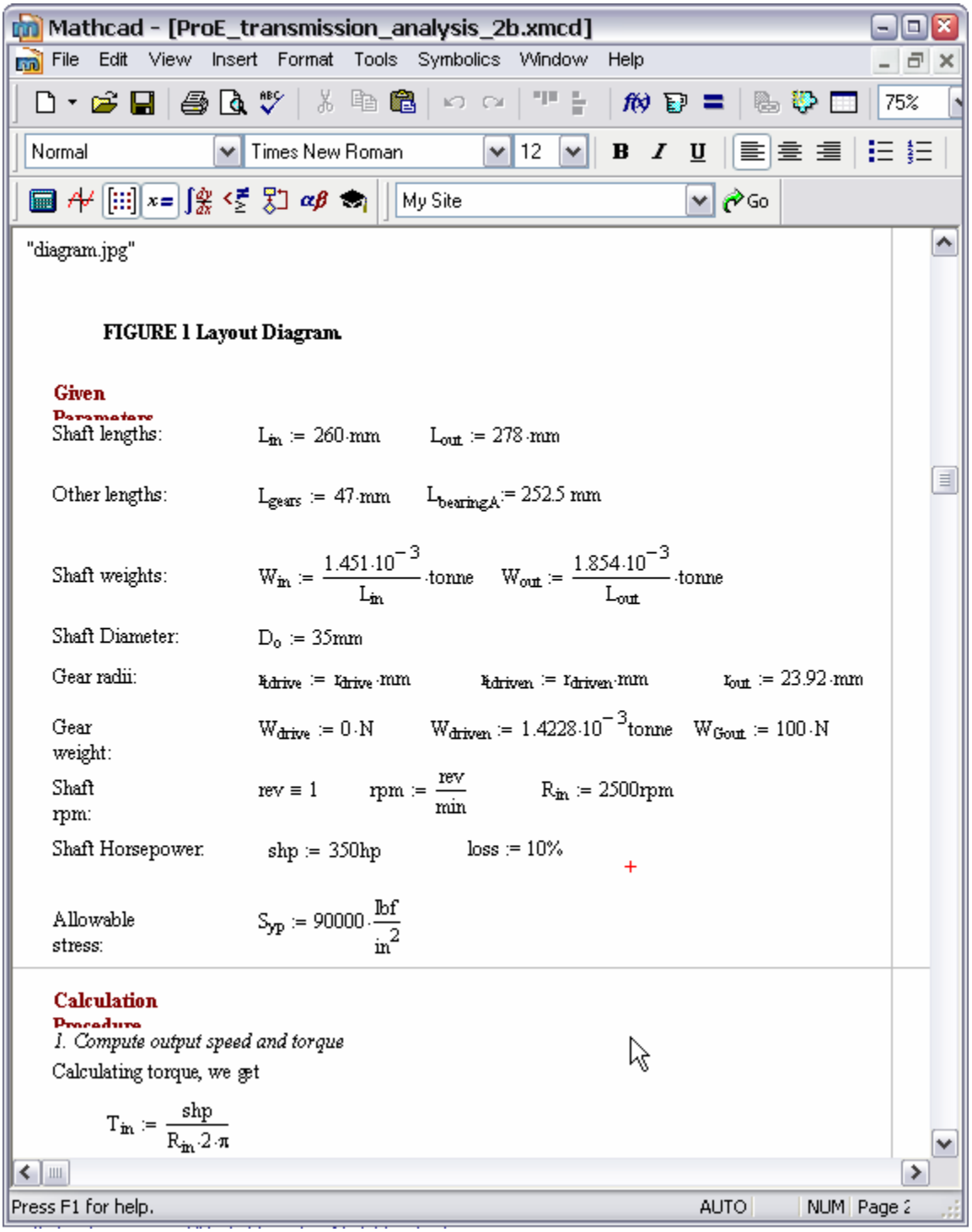
This release delivers an integration between Mathcad 13.1 and Pro/ENGINEER Wildfire 3.0 M030.

Customers currently using Pro/ENGINEER Wildfire 2.0 can download a toolkit-based application allowing them to integrate Mathcad 13 and Pro/ENGINEER Wildfire 2.0. This less formal integration will enable the use of Mathcad parameters in Pro/ENGINEER models.

How Do I set up the integration between Mathcad and Pro/Engineer?

The basis of the integration is mapping Mathcad values to Pro/Engineer parameters and Dimensions.

Starting with your Mathcad worksheet, you need to identify the values that you wish to pass to, or receive from, Pro/Engineer.


Mathcad - [ProE_transmission_analysis_2b.xmcd]
File Edit View Insert Format Tools Symbolics Window Help
Normal
Times New Roman
12
My Site
Go
"diagram.jpg"
FIGURE 1 Layout Diagram.
Given
Parameters
Shaft lengths:
$L_{in} := 260 \cdot mm$
$L_{out} := 278 \cdot mm$
Other lengths:
$L_{gears} := 47 \cdot mm$
$L_{bearingA} := 252.5\ mm$
Shaft weights:
$W_{in} := \frac{1.451 \cdot 10^{-3}}{L_{in}} \cdot tonne$
$W_{out} := \frac{1.854 \cdot 10^{-3}}{L_{out}} \cdot tonne$
Shaft Diameter:
$D_o := 35mm$
Gear radii:
$r_{drive} := r_{drive} \cdot mm$
$r_{driven} := r_{driven} \cdot mm$
$r_{out} := 23.92 \cdot mm$
Gear weight:
$W_{drive} := 0 \cdot N$
$W_{driven} := 1.4228 \cdot 10^{-3} tonne$
$W_{Gout} := 100 \cdot N$
Shaft rpm:
$rev \equiv 1$
$rpm := \frac{rev}{min}$
$R_{in} := 2500rpm$
Shaft Horsepower:
$shp := 350hp$
$loss := 10\%$
Allowable stress:
$S_{yp} := 90000 \cdot \frac{lbf}{in^2}$
Calculation
Procedure
1. Compute output speed and torque
Calculating torque, we get
$T_{in} := \frac{shp}{R_{in} \cdot 2 \cdot \pi}$
Press F1 for help.
AUTO
NUM
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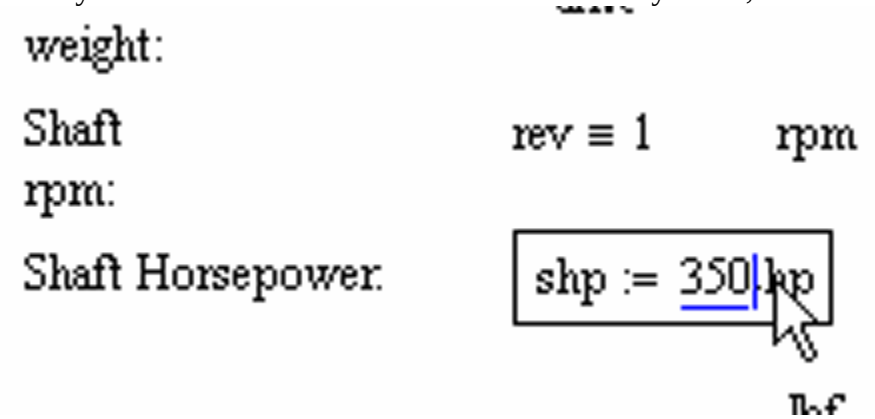
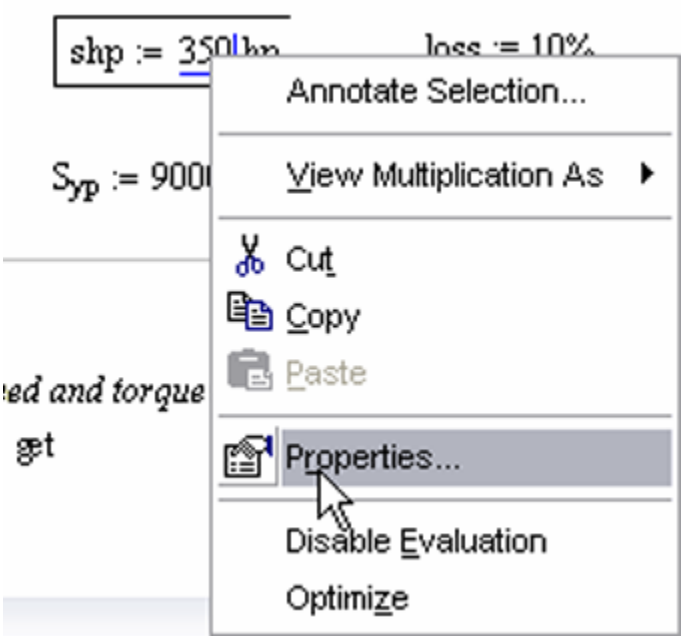
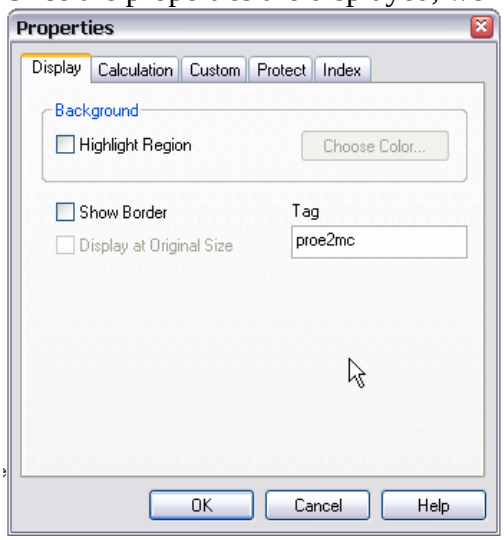
Once you have decided which variables are to be dynamic, select them,



and then right click to select Properties.

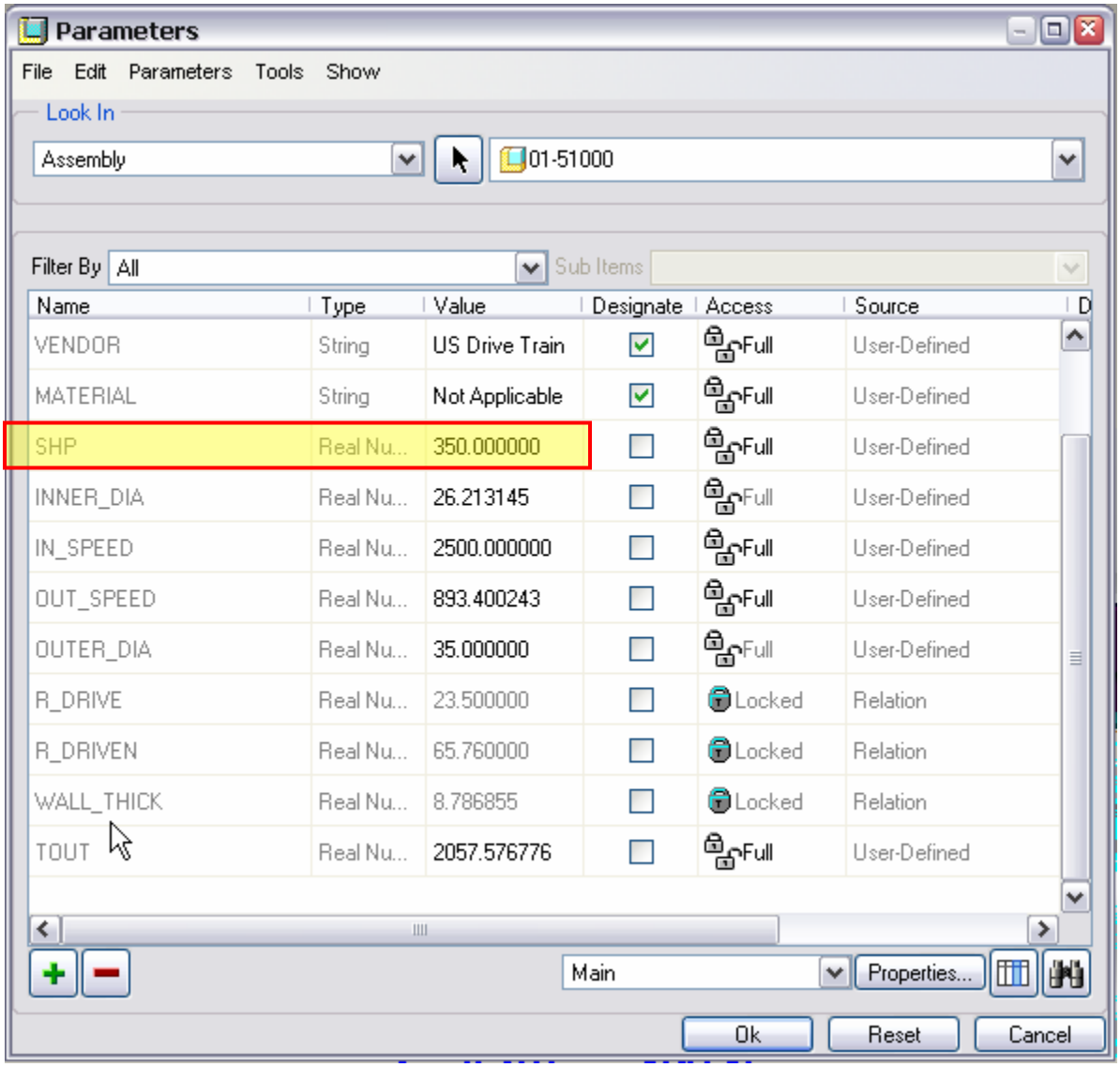


Once the properties are displayed, we need to tag the value with one of two options:

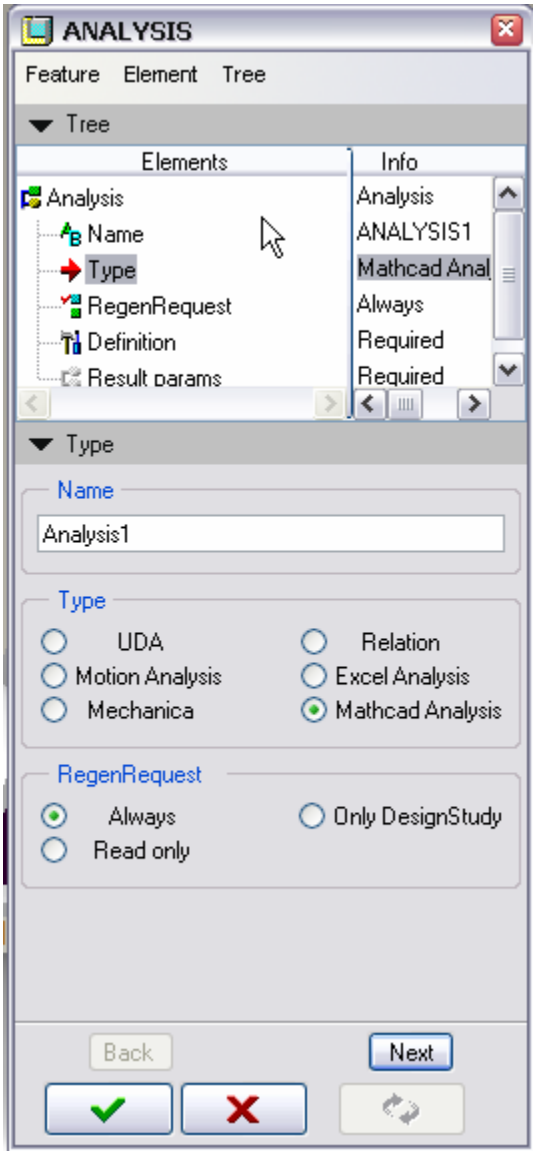


Proe2mc = value is driven from Pro/Engineer to Mathcad
Mc2proe = value is driven from Mathcad to Pro/Engineer

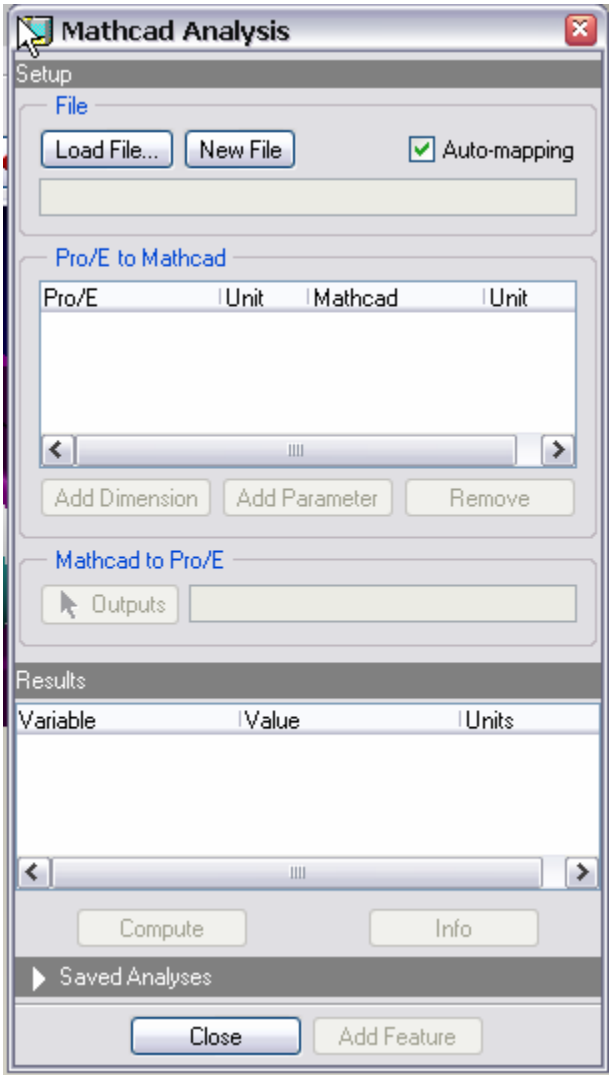
Within Pro/Engineer, parameters can be set up to enable easy changes to the design:



To link the Pro/Engineer model to the Mathcad sheet, an analysis feature is used (Analysis → Mathcad, or )



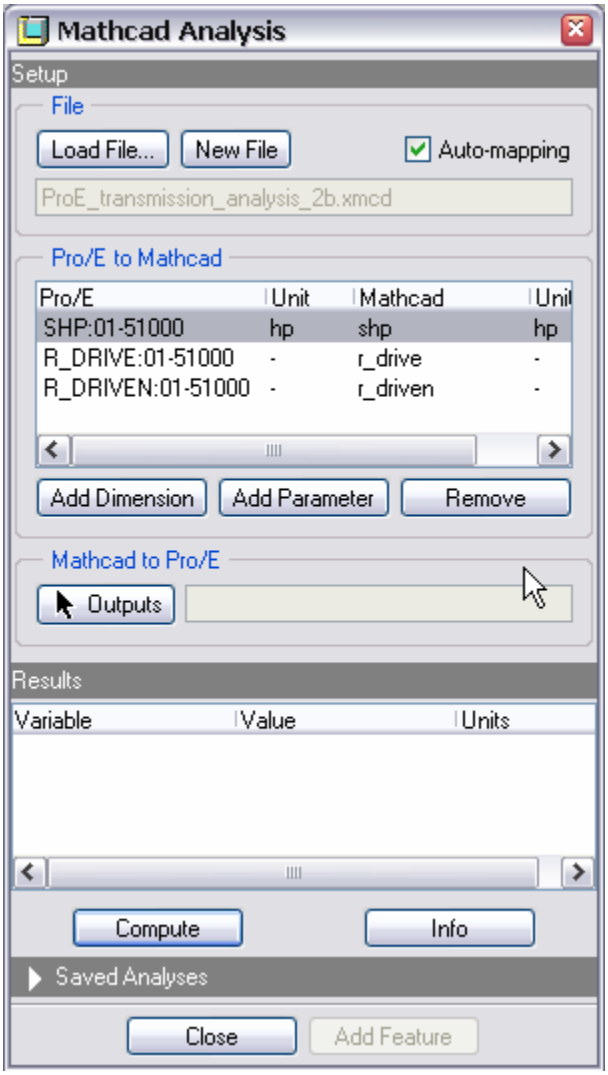
Note the regeneration options can be set at this time. Once Mathcad analysis is selected, click Next.



At this point we select the mathcad file using the Load File button.

Checking the Automapping option will automatically attempt to map Mathcad variables with Pro/Engineer parameters. This can be set by default with the config.pro option auto_mapping yes

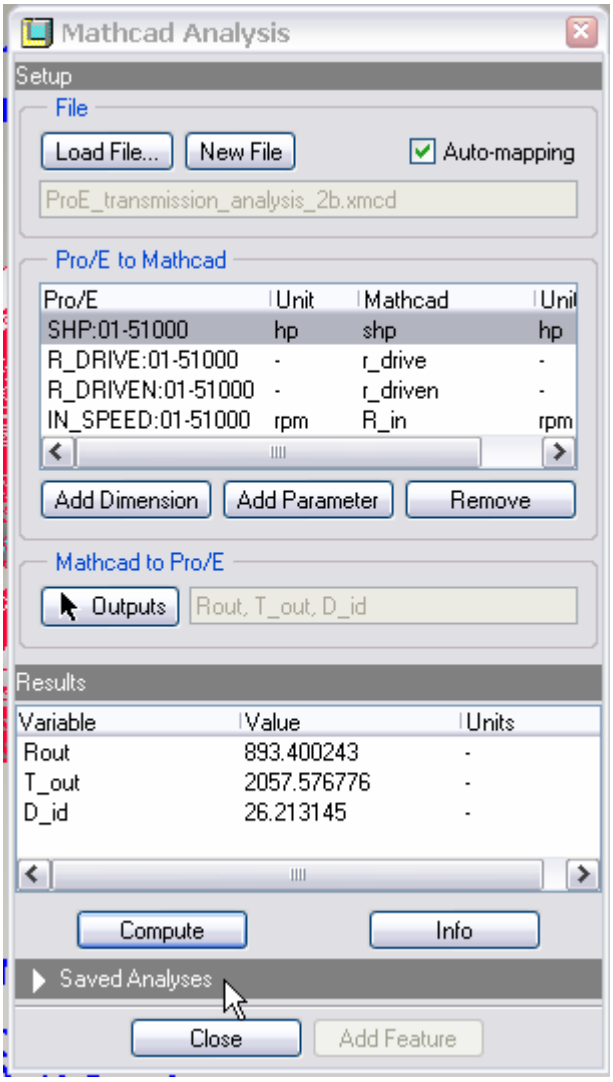
Automapping will attempt to map variables with the same name and units. To map variables and parameters (or dimensions) with dis-similar names, the Add Dimension or Add Parameter button can be used.



Here are the variables from the Mathcad worksheet. Note that the Units need to be identical in Pro/Engineer and Mathcad.

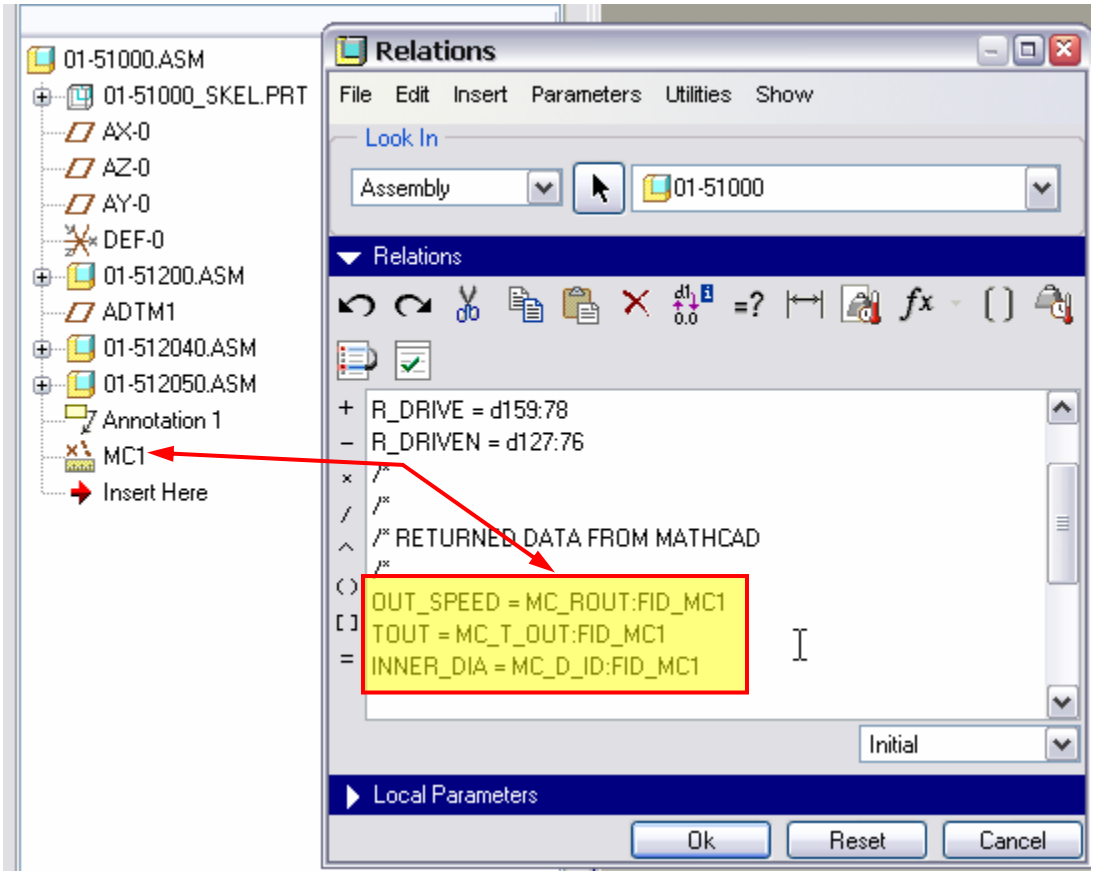
Selecting the Outputs button allows us to select the parameters and values we wish to pass from Mathcad to Pro/Engineer.

Once the inputs and outputs are specified, clicking Compute will run the variables through the Mathcad worksheet and provide an answer.



At this point we can close the feature, as the results will automatically create parameters in Pro/Engineer.

The final thing to do is link the derived parameters to Pro/Engineer features or Parameters via relations:



Now, when variables are changed in Pro/Engineer, and the model regenerated, Mathcad's calculations will drive the model.
Note that 2 regenerations are needed: the first regenerates the values and parameters, the second regenerates the geometry.

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PTC's Portfolio Management Solution

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Tips of the Month

Bringing Your Skeletons to Life

New in Wildfire 3!

With motion skeleton models, you can use mechanism design at the beginning of the design process. Thus, you eliminate the need to recreate assemblies that require mechanism analysis but were fully constrained by skeleton models and data sharing features.

You can create mechanism bodies within the motion skeleton and define connections. A simple kinematic analysis can ensures that the mechanism skeleton provides the appropriate degrees of freedom. You can then create and assemble parts to the individual skeleton bodies. Because motion skeletons are true skeleton models, they have reference control settings and will not show in the bill of materials for the assembly.

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Tips of the Month

CAD Document Attachments and Managing Instance Accelerator Files

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Announcements

Educational Resource Library

Learn things you always wanted to do - but didn't know you could.

This one stop educational resource library will help you learn more about PTC Solutions and provide you with technical materials developed by the product experts to help you become more productive.

Get tutorials, how-to videos and expert advice for:

- Pro/ENGINEER
  - Conceptual and Industrial Design
  - Detailed Design
  - Simulation/Analysis
  - Production
  - Design Collaboration
- Windchill PDMLink
- Windchill ProjectLink
- Pro/INTRALINK
- PTC Online Tools

Check out the Educational Resource Library today.

PTC Tips & Techniques Newsletter Archives

Miss an issue! Can't find that awesome technique you read about? Fear not, you can click on the link below and go through our Customer PTC E-Newsletter archives.

Click Here To Access

It's better than finding the Covenant of the Ark!

PTC Tips & Techniques Webcasts: Work Smarter. Not Harder.

Click below to see regularly scheduled Tips & Techniques technical Webcasts that are designed to provide you with the most popular time-saving tricks that Pro/ENGINEER users of all skill levels will find useful. Get more out of your maintenance dollars!

Tips & Techniques: Work Smarter Not Harder!

E-PROFILES IS HERE!!

We have been eagerly anticipating the debut of the new electronic version of Profiles Magazine and now it is here! This new web site will supplement the print edition of the magazine and will

provide new useful features not feasible with paper media. e-Profiles will provide you with 24x7, worldwide access to key information previously available exclusively in the print version. "Tips & Tricks," a popular feature pioneered by Pro/USER, has also moved to the web and will be expanded as the site matures.
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, 2007	Your local Pro/Engineer User Groups http://www.ptcuser.org/rugs/
June 3 - 6, 2007	Tampa, Florida PTC/USER International Conference 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.

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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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