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new!

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PTC Product Focus

Pro/ENGINEER Fatigue Advisor

Pro/ENGINEER Fatigue Advisor is a unique product, intended specifically for designers who need to understand the durability of their products. Not only does Pro/ENGINEER Fatigue Advisor give you an up-front assessment of your product's durability, but it also enables you to understand the impact that design changes have on the fatigue life of the component.

Metal components subjected to repeated cycles of loading and unloading can fail even though the maximum stresses developed are well below safe static values. With 80 to 90% of all structural failures resulting from fatigue, think of the advantage you'd have if you could evaluate your designs for durability right from the outset of the design process.

Pro/ENGINEER Fatigue Advisor provides the tools necessary to design for durability and quality. As an integral part of the Pro/ENGINEER product family, it can be used throughout the design process, from concept through detailed design. By giving engineers feedback on the fatigue life of their designs early in this process, they can engineer the life of the product into the design, rather than handle unforeseen issues during a lengthy and costly prototype testing phase.

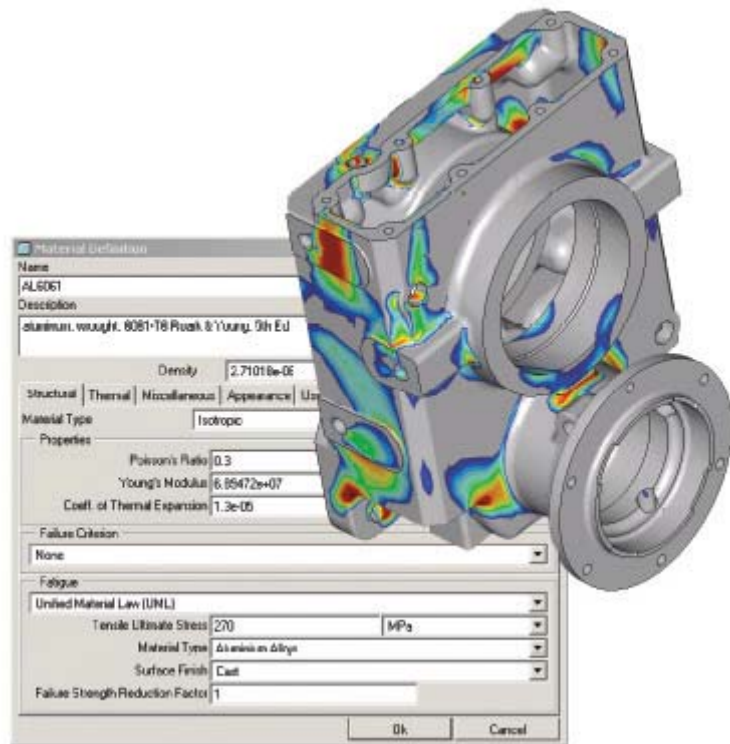
Pro/ENGINEER Fatigue Advisor makes it easy to set up models for evaluation. The material properties necessary can either be computed from the Pro/ENGINEER material definitions by specifying information such as surface finish and treatments applied, or by importing the full fatigue materials property definitions, if available. Next, the load history, which will be applied to the simulation, is defined for a selected static analysis. And, lastly, the simulation is executed. All model definition is part of the Pro/ENGINEER model and, as such, updates associatively as the model undergoes design iterations.

The output of the fatigue analysis includes product life, damage to the model, factor of safety, as well as a confidence of life plot. The confidence of life plot provides a quick go/no-go assessment of the simulated life of the component against a user-defined goal. Pro/ENGINEER Fatigue Advisor's seamless integration with Pro/ENGINEER Mechanica also allows you to use the results in design studies such as sensitivity or optimization studies. Using results from a Pro/ENGINEER Fatigue Advisor analysis extends the range of optimization to include examples

such as minimizing the weight of a component, while maintaining the fatigue life within a predefined range.

Key Benefits

- Reduce product warranty costs by creating more durable products
- Eliminate lengthy, costly physical prototyping phases of design validation
- Improve product quality and durability using embedded optimization technology
- Identify design issues requiring improvement early, when the cost of change is minimal
- Design with more confidence throughout the product lifecycle



Features and Specifications

Results of Fatigue Analysis

- Accurately predict the life of the product by determining the number of cycles to failure
- Understand the damage to product, expressed as the ratio between accumulated fatigue cycles and the total number of cycles to failure
- View Factor of Safety results for information on the extent to which the amplitude of the load can be increased without compromising the target design life
- Represent Confidence of Life as a fringe display showing the ratio between the calculated life and the target design life

Leverage all post-processing and reporting capabilities of Pro/ENGINEER Mechanical

- Examine results in fringe plots or other formats available within Pro/ENGINEER Mechanical
- Export information to HTML for sharing results throughout your organization

Load history definition tools

- Constant Amplitude (peak-peak, zero-peak, user-defined)
- Variable Amplitude (populate a table manually or by importing from file)

Fatigue material properties

- Computed from Pro/ENGINEER materials library using Unified Material Law (UML)
- Imported from file

Data interoperability with FE-Fatigue from nCode International provides scalability for expert analysis

Access to override internal defaults enables fatigue experts to control advanced configuration and use less conservative solution settings

Support for fatigue-specific measures

- Achieve desired measure result values through Optimization studies, or investigate ‘what-if’ scenarios via Sensitivity studies
- Track incremental improvements accurately

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PTC Product Focus

ProjectLink Role Configuration

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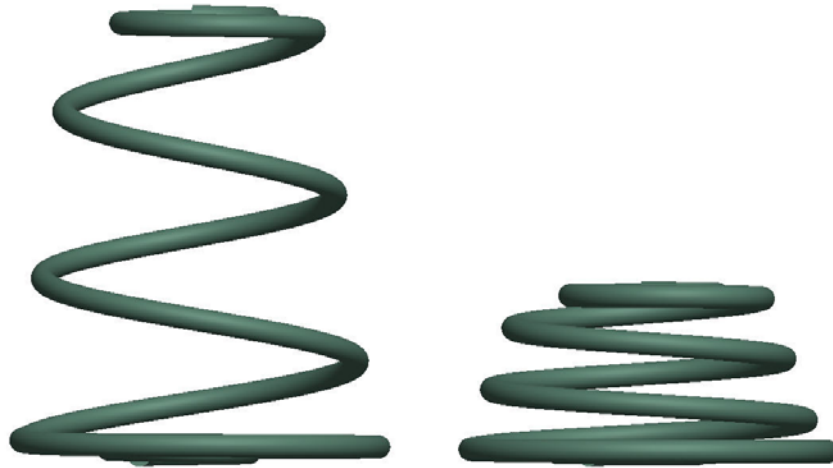
Tips of the Month

Datum Graphs and Sketcher Relations



So what do you do when faced with a challenge like this spring? You know about helical sweeps and you're pretty confident you could get the middle part of this, but dealing with variable pitch graphs isn't really something you'd like to tackle.

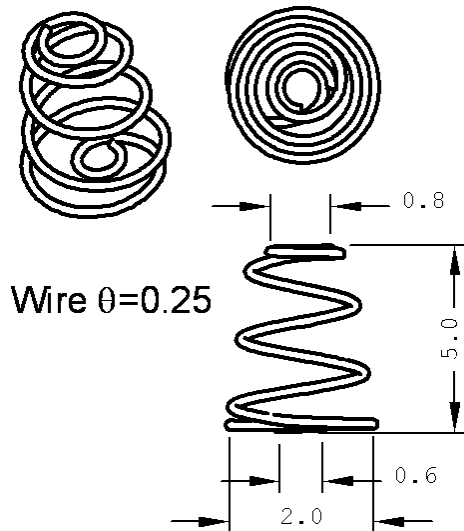
To make matters worse, it needs to be a flexible component! Now what?



Fortunately, using a little bit of "old-school", this can be modeled quickly using a couple of simple graphs and some variable-section sweep magic.

Details

Unless springs are your business, this component is probably just in the assembly for show and you're not that interested in being exact, so the following info is all that's really needed.

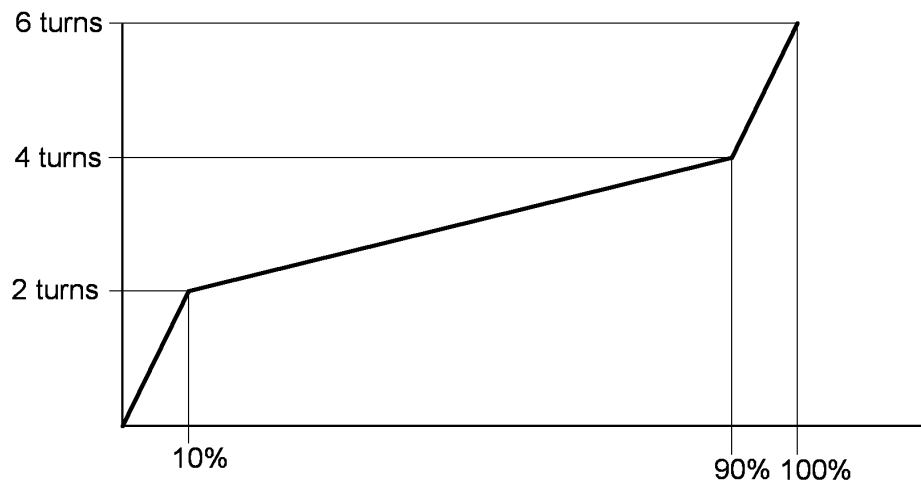


There are a few things to take note of besides the dimensions:

- There are $5 \frac{3}{4}$ turns in this spring
- The middle section is more-or-less conical
- The beginning and end are circular sections (constant radius)
- The base is pretty flat for about 2 turns

The Approach

Think of the spring as a coil wound around a center post of some height. If the post's height changes, the spring will elongate or compress but the location of each turn will stay at the same relative location along the post. We can take advantage of this by defining a graphical relationship of turns vs. %length

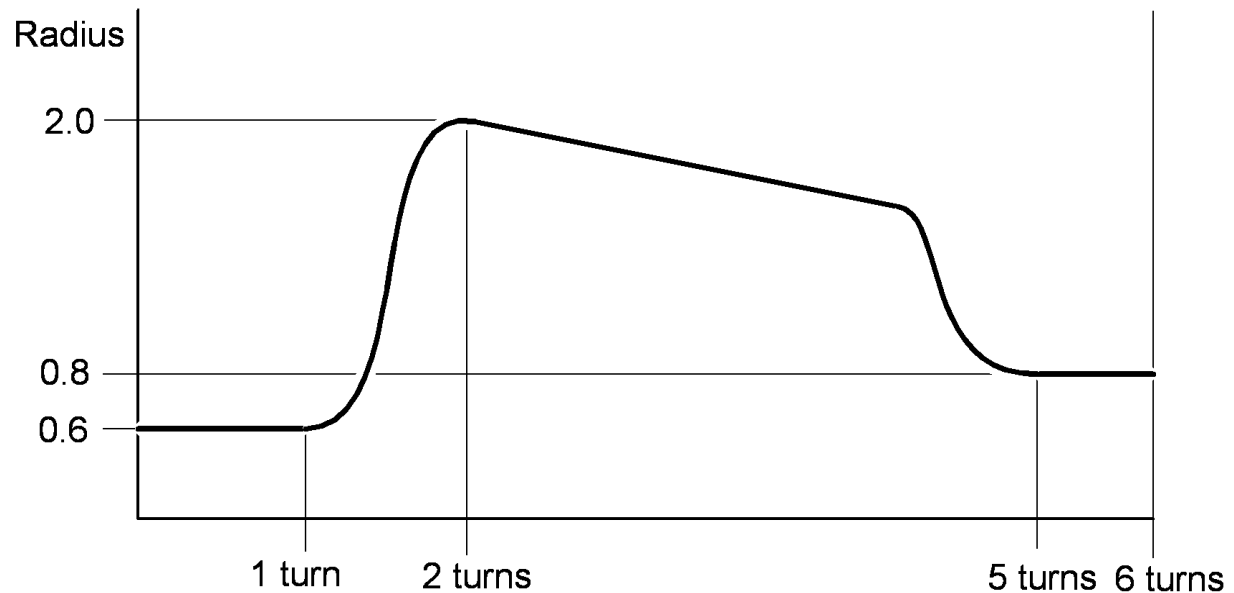


In the graph above, the first two and last two turns are completed in just 10% of the length of the spring each. The middle two turns take up the remaining 80%. This is similar to what we want our spring to do.

The radius of the coil at any location could be tackled similarly by defining a “Radius vs. %Length” graph. Unfortunately, in our spring, the radius starts out quite small and constant for about 1 turn and then transitions to something much larger over the next turn. This all happens

in the span of that first 10% of the height. The resulting “Radius vs. %Length” graph would be rather squashed and difficult to create and modify.

A better approach would be to define a “Radius vs. Turns” graph instead.



In the graph above, notice how we’re taking what we can visually see with the spring and turning it into data for our model: For one turn the radius is .6, at 2 turns the radius is 2.0, the radius decreases linearly and then transitions to be .8 at 5 turns.

You may have noticed that this last graph is dependent on the first graph. To know the radius of the coil at 50% of the height, you will need to determine from the first graph how many turns have occurred and then look up the radius on the second graph. This may seem complex but if you take each graph by itself, it’s simple and based on the observable data. We’ll let Pro/ENGINEER do the heavy lifting of creating the geometry for us.

Modeling

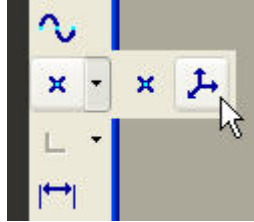
There are very few features in this spring model. They are:

- 3 datum planes and a coordinate system (of course)
- 2 datum graphs similar to what was outlined above
- 1 sketched datum curve to determine the extent of the spring
- 1 variable section swept surface
- 1 composite datum curve along the edge of the surface
- 1 solid sweep along the datum curve

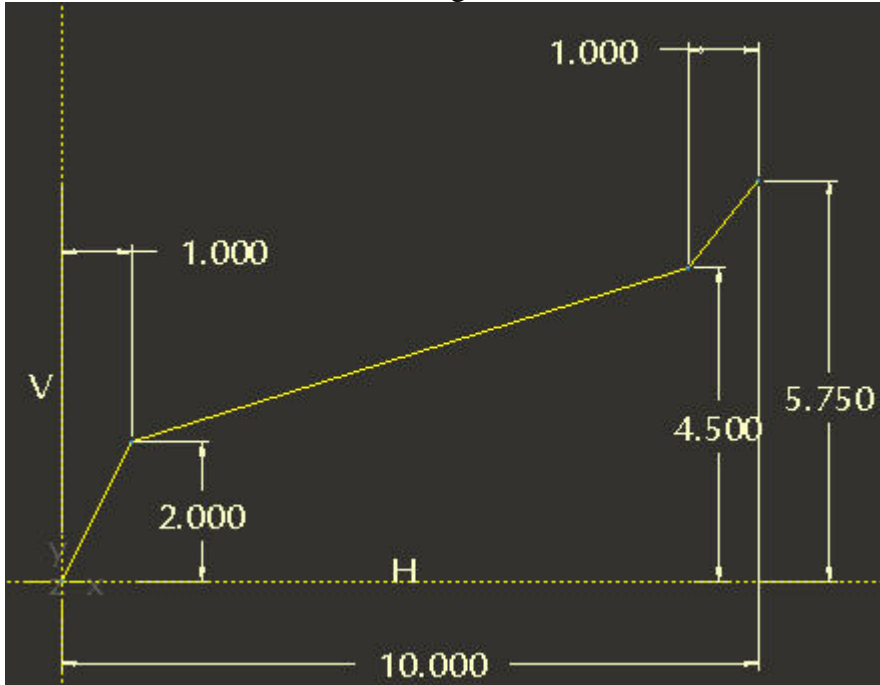
The “Turns” Datum Graph Feature


- INSERT / MODEL DATUM / GRAPH...
- Name this feature “turns”
- You’re presented with a blank sketcher screen.
- Place a sketcher coordinate system somewhere in the lower left corner

- Hint, the sketcher coordinate system can be found in the sketch point flyout



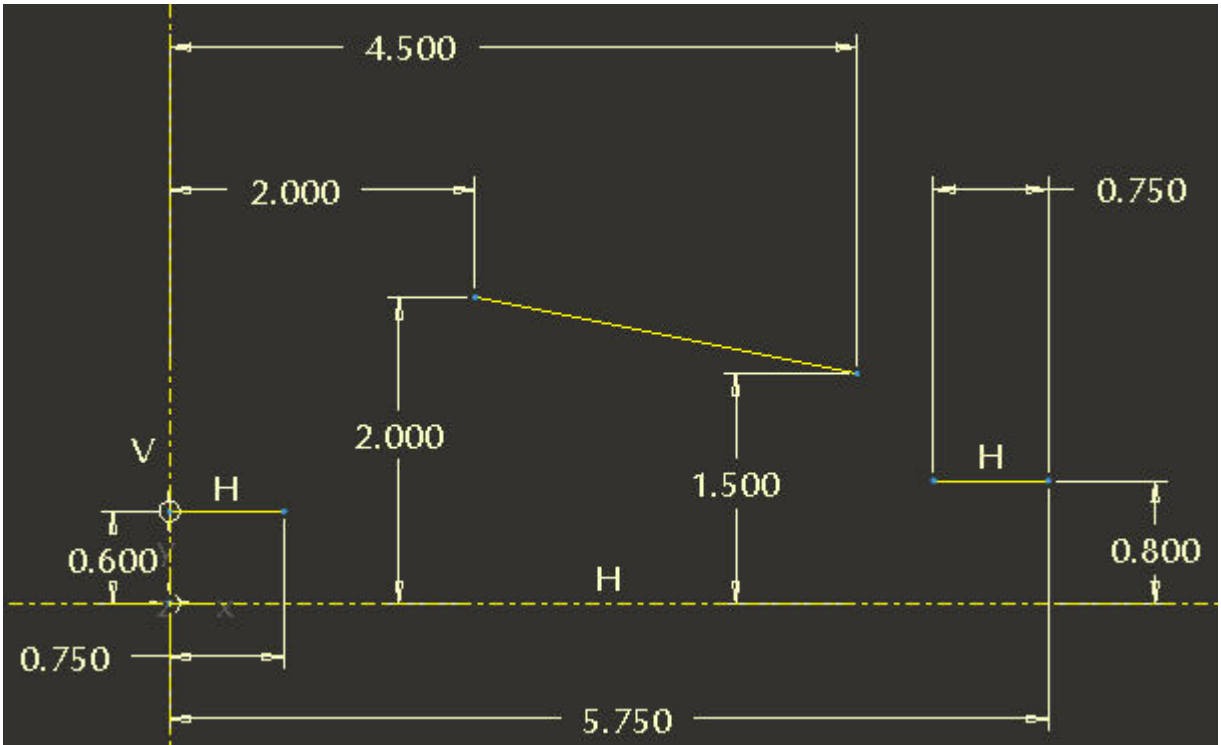
- This creates a (0,0) reference for our graph
- Add vertical and horizontal centerlines going through the coordinate system to give you something to anchor to (but they're not required)
- Sketch and dimension the following




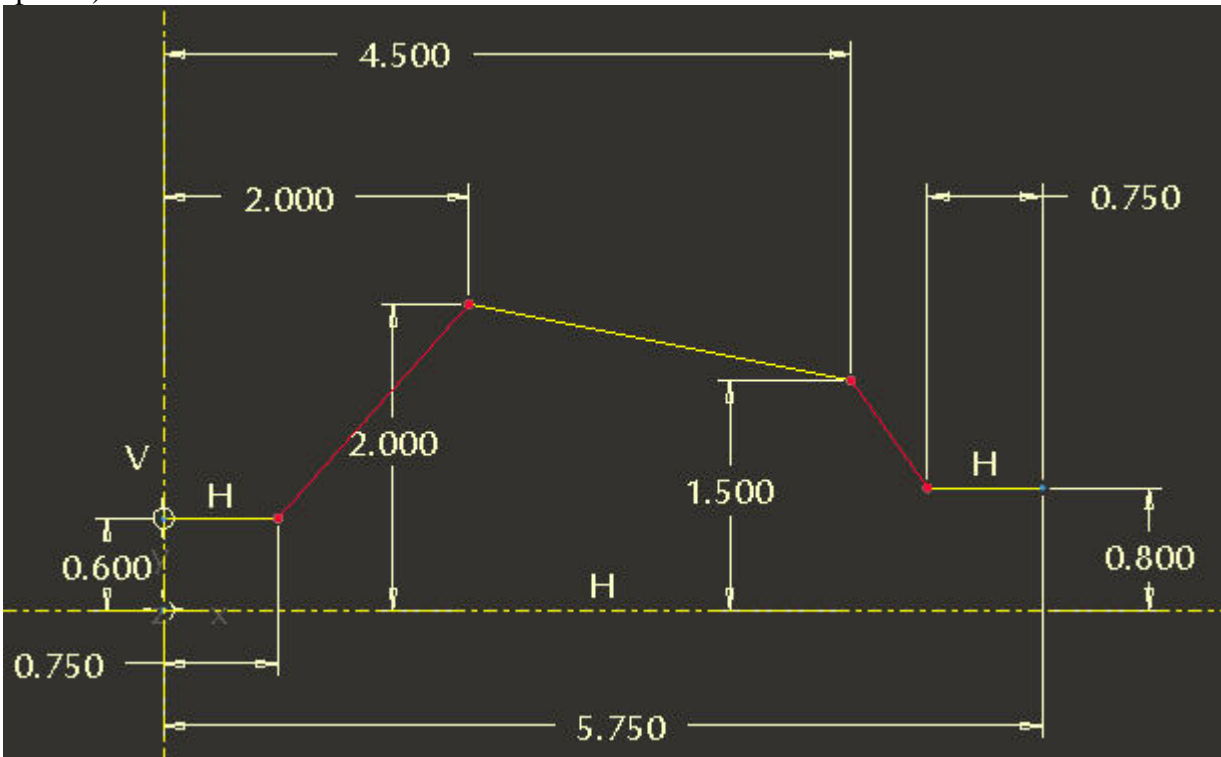
- Remember our spring has $5 \frac{3}{4}$ turns thus the maximum vertical dimension
- The 10.000 represents 100% of the spring height (could have used any number here – it'll be taken out in a relation later)
- Finish the sketch and you should have added  TURNS to your model tree



The “Radius” Datum Graph Feature

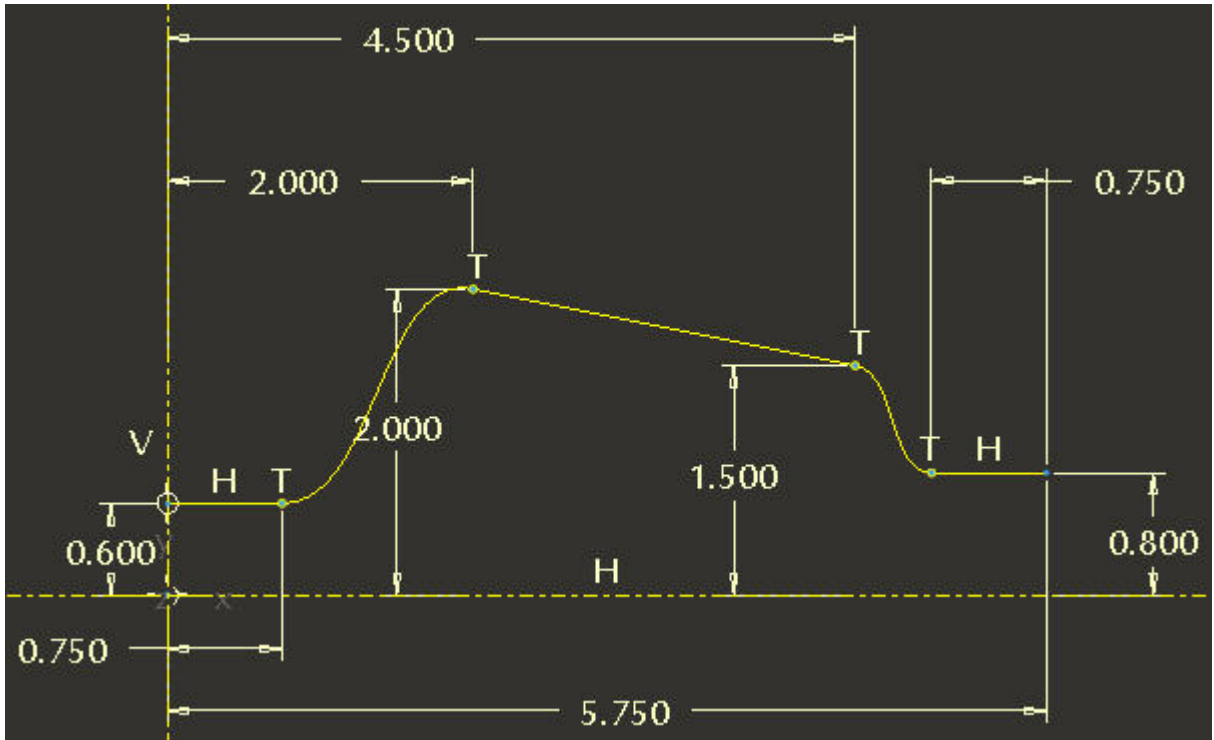
- INSERT / MODEL DATUM / GRAPH... again
- Name this one “radius”
- Sketch and dimension the following disjointed sketch (don't forget the sketcher coordinate system)



- Now, click the spline tool icon  and sketch 2 two-point splines across the 2 gaps
- The sketch should look like the following (note the red highlighted entities are the splines)



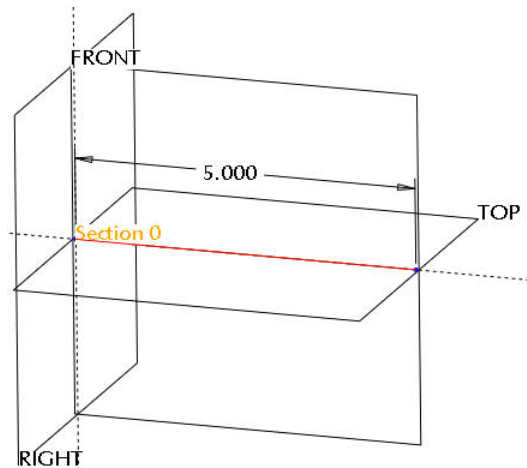
- Use the constraint dialog, , and the tangent tool, , to make the splines tangent with the adjacent straight segments
- The finished sketch should look like this




- Finish the sketch and you should see the added  RADIUS feature

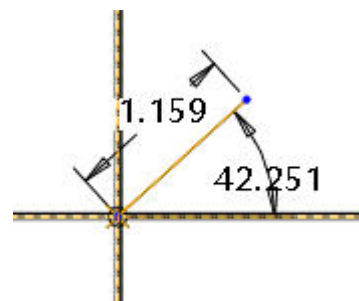
The Sketched Datum Curve Feature

- Sketch a 5 inch long, straight curve on the FRONT plane and located on the TOP plane

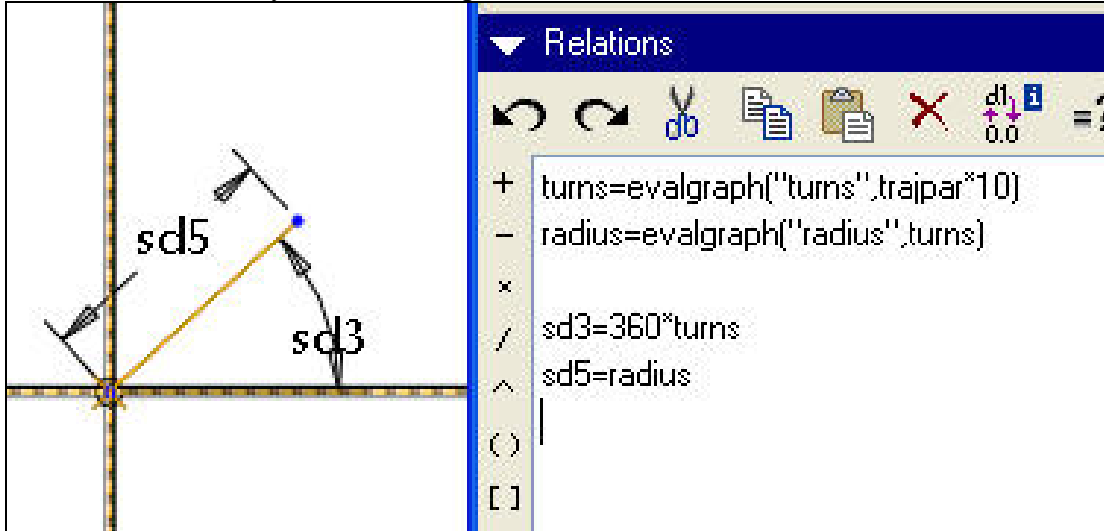


The Variable-Section Sweep Feature

- Select the curve you just sketched
- INSERT / VARIABLE SECTION SWEEP...
- Click the sketch icon,  from the dashboard
- Sketch and dimension a single line as shown below (the dimension values are not important, just be sure to have a line-length and an angle dimension)

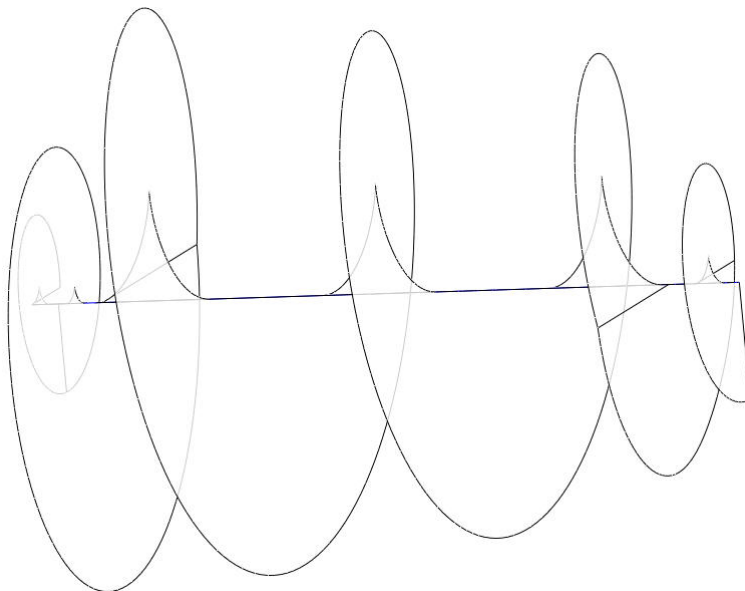


- TOOLS / RELATIONS...
- The sketch dimensions will change to “sd#” parameters. Type the relations as shown below but substitute your “sd#”s in place of “sd3” and “sd5” if different.




- Note: The function “evalgraph” evaluates the graph named in the quotes. It returns the Y value of the graph based on the X value given.
- For the “turns” function, remember the graph we sketched went from 0 to 10 (meaning 0-100% of the spring height). “trajpar” is a variable-section sweep parameter that goes from 0 to 1 along the length of the sweep. So “trajpar*10” equals a number that ranges from 0 to 10 along the sweep. Passing that value into our “turns” datum graph will return the appropriate value.
- For the “radius” function, we’re passing in the number of turns and getting back the radius. Remember that these are continuous functions and are being evaluated along the sweep.
- $Sd3=360*turns$ simply rotates the sketched line the correct angle to equal the number of turns
- $Sd5=radius$ is self explanatory

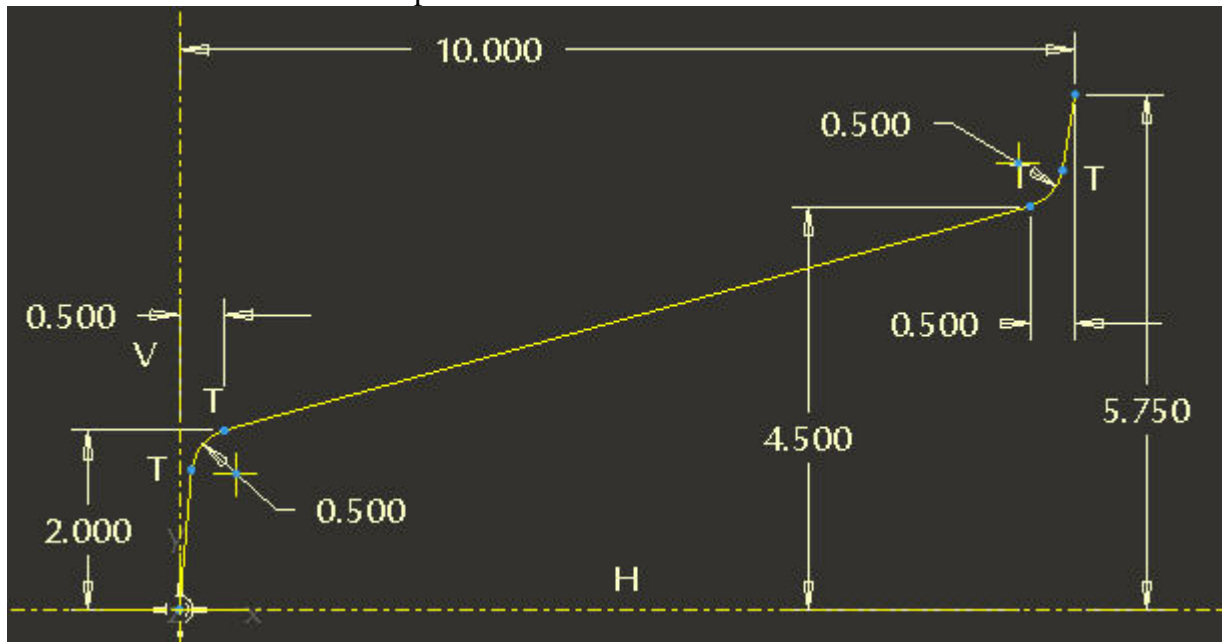
- Clicking OK will cause the sketch to change to the starting values as defined in the graph (that usually means a zero angle)
- Finish the sketch to see the preview
- Finish the feature



Redefine the “TURNS” datum graph feature

If you look close you’ll see that some of those radial lines are actually sharp transitions. This is due to the fact that the “turns” datum graph had sharp corners in it. We’re not going to want these sharp transitions so let’s make the change now and while we’re at it, go ahead and tighten up the coil at the bottom and top.

- Edit definition of the “TURNS” feature
- Choose DONE from the menu-manager
- Accept,  the name of the feature (or just press ENTER)
- Add a 0.5 radius at the two sharp corners. Dimension it like this:

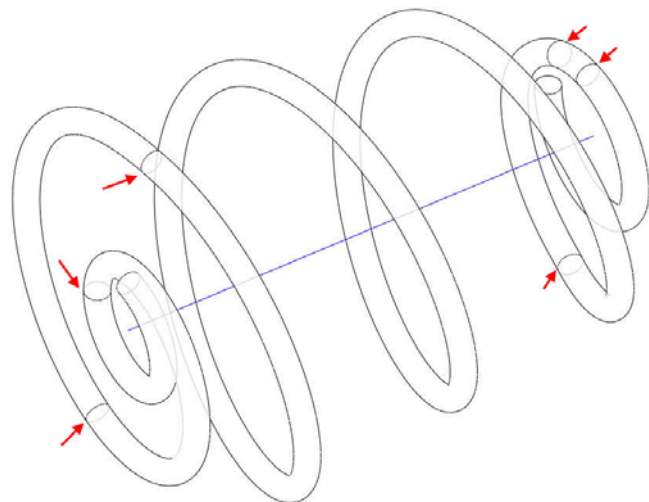


- Finish the sketch and check out the results

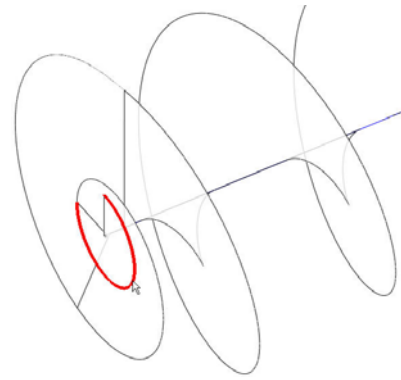
The Composite Datum Curve Feature

It’s now a very simple matter to sweep a circular cross-section along the outside edge of this crazy variable-section sweep to get our spring. If we do that however the result is OK but it could be better. Here’s what you’ll get:

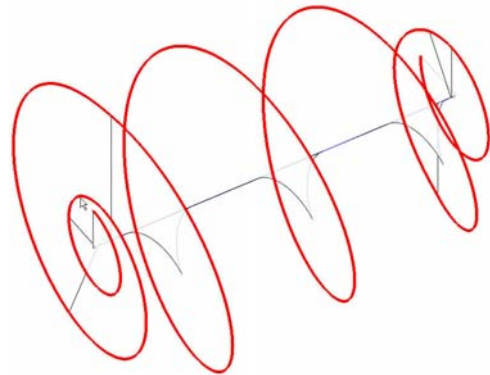
Notice all the little circular breaks in the surface of the wire. These are created everywhere the graph changes curvature. These are not necessarily a bad thing, but an added, simple step will get rid of them.



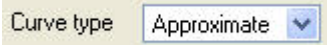
- Select the variable-section sweep feature
- Then select the starting edge as shown



- Now, hold down the SHIFT key and select the adjacent tangent edge (if you wait for a moment, the “tangent” tag should pop-up)




- EDIT / COPY (or ctrl-c)
- EDIT / PASTE (or ctrl-v)
- Change the Curve type to “Approximate” in the dashboard

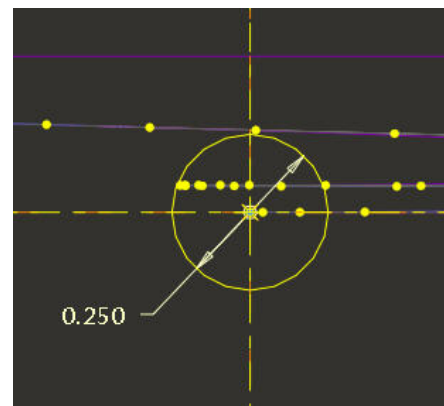


- Finish the feature

The Final Sweep Feature

- With the composite curve you just created selected, INSERT / VARIABLE SECTION SWEEP...

- Click the sketch icon,  from the dashboard
- On the cross-hairs, sketch and dimension a .25 inch diameter circle

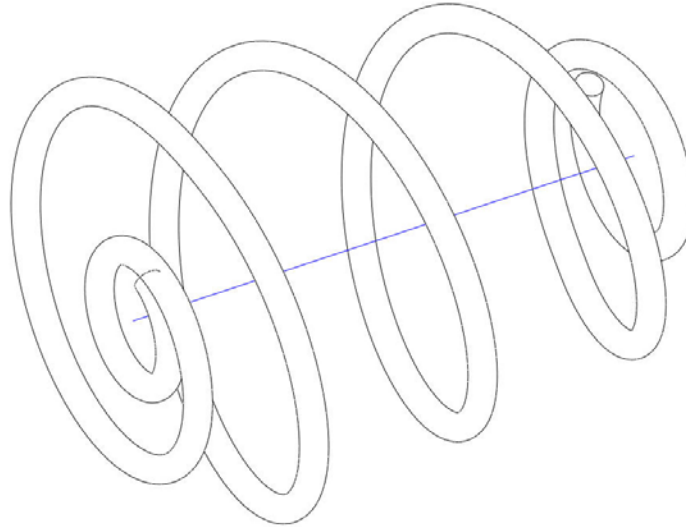


- Finish the sketch

- Be sure to change the sweep to a Solid Sweep



- Finish the feature



The Finish

- Finish things off by hiding the first Var Sect Sweep feature
- Modify the sketched curve to be shorter or longer and regenerate
- Of course both the “TURNS” and “RADIUS” datum graph features can also be redefined to create some very interesting geometry.

Congratulations, you’ve just experienced two of the most powerful features in the Pro/ENGINEER arsenal, datum graphs and sketcher relations. There are, of course, many more uses for this and other powerful capabilities of Pro/ENGINEER beyond creating crazy springs. To learn more about Pro/ENGINEER and its capabilities, please visit www.ptc.com, attend a user conference, speak with your PTC representative or partner, or check out the wealth of related websites on the web.

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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.

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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.

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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 1 – 4, 2008 Long Beach, CA 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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