Circular Patterns in CPQ 3D Scenes Transcript

In this course, you will learn the theory of circular patterns by watching a real-world example of how to use this feature to solve a design problem.

Objectives

- Circular Pattern Theory & Example
- Circular Pattern manipulations with Snap
- Circular Pattern: Beyond the basics Theory

Circular Pattern Theory & Example

Use the circular pattern feature to repeat a mesh along a curved line.

Select the mesh you'd like to repeat. Here, we have a primitive box called gear tooth, positioned three units down the X axis. Its shape properties are 0.5 on each side.

- In the properties column on the right, open the features expander, and add a new **circular pattern** feature.

1. As with all features, you can change the **name** of the feature to make future Snap programming easier.
2. Set the **pattern count** to the number of meshes you want to appear.
3. Set the **pivot** to describe the point in space, relative to the mesh's origin, around which the circle of duplicates will appear.
4. Set the **axis** to define a vector, starting at the pivot, that describes how the circle of duplicates will appear.

   As you recall from the introduction to moving and rotating meshes in a scene, a vector is a combination of 3 numbers. It can describe a point in 3D space, like this one.

   A vector can also describe a line. With the start of the line at the origin [0,0,0] and the end of the line at three numbers you specify, you can easily describe a line of any length, pointing in any direction.

   For example, an axis with a simple vector of y=1 means an axis pointing straight up from the pivot. The duplicates will appear rotating around this vector, like chairs around a table. An axis with z=1 means an axis pointing to one side of the pivot. These duplicates will appear like spokes around a bicycle wheel.

   The circular pattern is not limited to just one of the three axes. An axis vector with more than one number, such as X=1, Y=1, points away from the pivot at an angle different from any of the 3 coordinate planes.
5. Changing the **pattern count** will add or remove duplicate meshes.

Circular Pattern manipulations with Snap

Like any other feature, circular patterns can be adjusted during run time with Snap rules.

Usually, the fields of data controlling this feature would come from a configurator, or some other source. For demonstration purposes, we will use fields within this stand-alone scene.

In this example, we want a customer to specify the number of teeth on their gear.

- To create the core of the gear, create a new primitive mesh cylinder.
  Give it a name of "Gear Core". Shape properties we used are height of 0.1, radius of 3, and tessellation of 60 for a smoother curved edge at larger sizes.

- Create a number field called "Count of Teeth".
  We've set our field with a default value of 12, precision 0, step 1, and constraints to ensure the count is between 4 and 30. We're using a slider control.

When we run the scene, we see the circular pattern and the field, but they are not connected.

- Create a new scene rule, called "Build Gear".

- Use the **set feature** block to set the count of the circular pattern feature called "Circular Pattern-Gear Teeth" of the mesh called "Gear Tooth".

When we run the scene, we see the circular pattern is now driven by the fields.

Let's adjust the size of the gear.

- First, clone the existing field, and name it "Gear Diameter".

- Then update your scene rule as seen here. Don't forget the math function block on the last line!

Now run the scene again. See that we can not only change the number of teeth, but also adjust the overall diameter.

Circular Pattern: Beyond the Basics

Circular Pattern is a powerful feature, but keep in mind some useful suggestions.

One common problem: patterns like this may not fill all the space you expect. In our gear example, you may want 6 teeth across half a circle. Note that the final gear is not at 180 degrees.

Why does this happen? Each repeated element in a pattern consists of both the mesh, and the space which follows the mesh. Positioning is calculated from both. Keeping the spacing in mind, we see the final element is positioned correctly.

In some cases, you may want to end with an element, not with the space that follows it. One solution: you can add the unwanted extra space of the final element to the total length of the pattern, so the last element appears as expected.

Another common question: how can you apply a circular pattern to multiple meshes, instead of just one? For example, maybe we want to add a diamond tip to the end of each tooth. How could we have the diamond tip be duplicated and positioned the same way as the tooth?

One solution is to treat the tip as a separate mesh, and manipulate it in parallel to the tooth mesh.

In other words, the tip would have a circular pattern feature (just like the tooth does), and Snap rules would manipulate that tip feature (just like they do the tooth feature).

Here's a best practice. Remember that meshes can easily overlap. If your circular pattern needs to place more duplicates in an arc than would actually fit, they simply overlap. Use this to your advantage. If the edges of your patterned meshes are designed well, they can look realistic even when they start to overlap.

Recap

As a recap,

- You reviewed the theory of how a circular pattern can repeat a mesh or group along a curved arc.
- You know how to automate the circular pattern feature using Snap rules.
- And you learned some tips and tricks in using this feature.

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