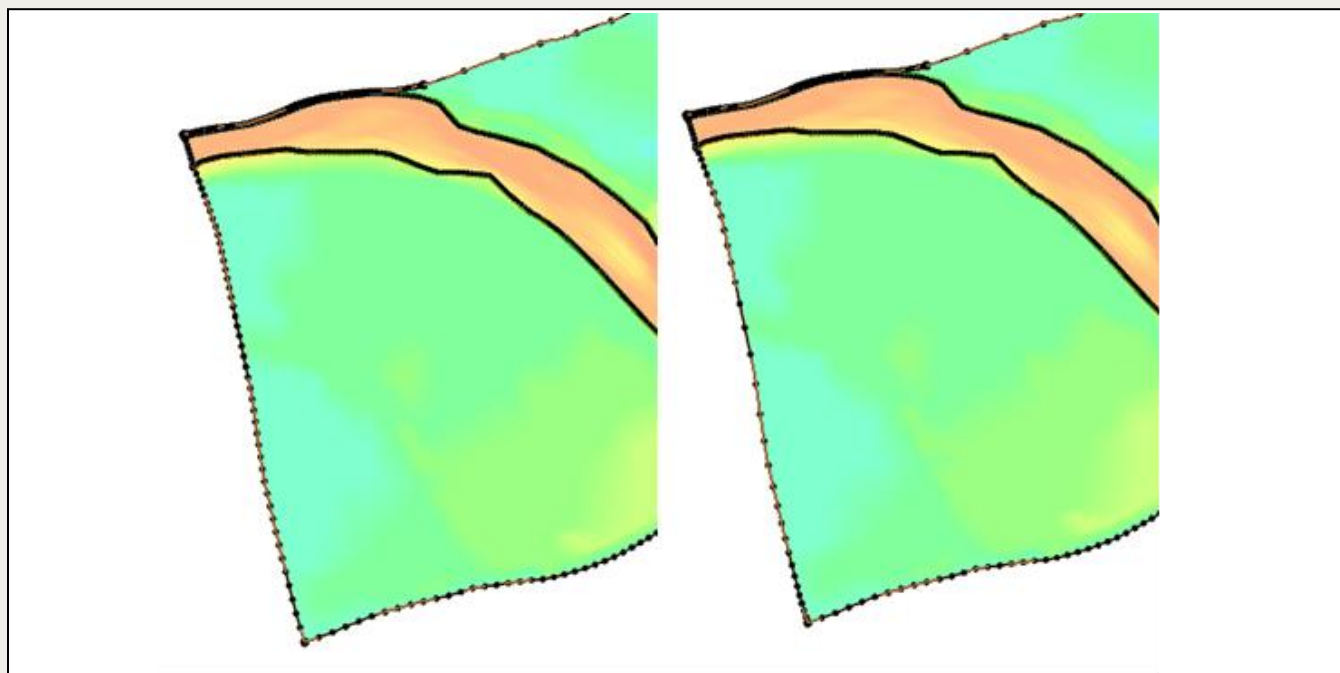




*SMS 14.0 Tutorial*

## **Redistribute Vertices**

Redistributing vertices along an arc



### Objectives

This tutorial discusses the various methods of redistributing vertices along an arc in the Map module.

#### Prerequisite Tutorials

- Overview
- Map Module

#### Required Components

- SMS Core

#### Time

- 15–20 minutes

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## 1 Introduction

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How vertices are distributed along an arc affects how a mesh is generated from a coverage and can also impact other applications in the Map module. Therefore, ensuring the vertices on an arc are distributed correctly is important in creating a working model.

Typically, the resolution of the vertices in the arcs is determined so as to be fine enough to define the desired shape and position.

In addition, the element density in an unstructured grid created from feature objects matches the density of vertices along the feature arcs, so it may be desirable to adjust the node distribution.

This tutorial will go over the different methods used to redistribute vertices.

## 2 Getting Started

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This tutorial starts with importing a project file containing several coverages which will be used to experiment with the different vertex redistributions. The file also contains a scatter set that includes a size function which will be used for one redistribution method. A background image and 2D mesh are included for reference.

To get started:

1. Start SMS.
2. If SMS is already open, select *File* | **New**.
3. Click **Do not Save** to clear all data in SMS.

### 2.1 Opening the Starting Project

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Do the following to open the project file:

1. Select *File* | **Open**. This will bring up the *Open* dialog.
2. Search the *data files* folder for this tutorial for the file "Cimarron.sms" and select the file.
3. Click **Open** to import the project.

The Graphics Window should be similar to Figure 1 but without the arc labels. The labels will be referred to through the rest of the tutorial.

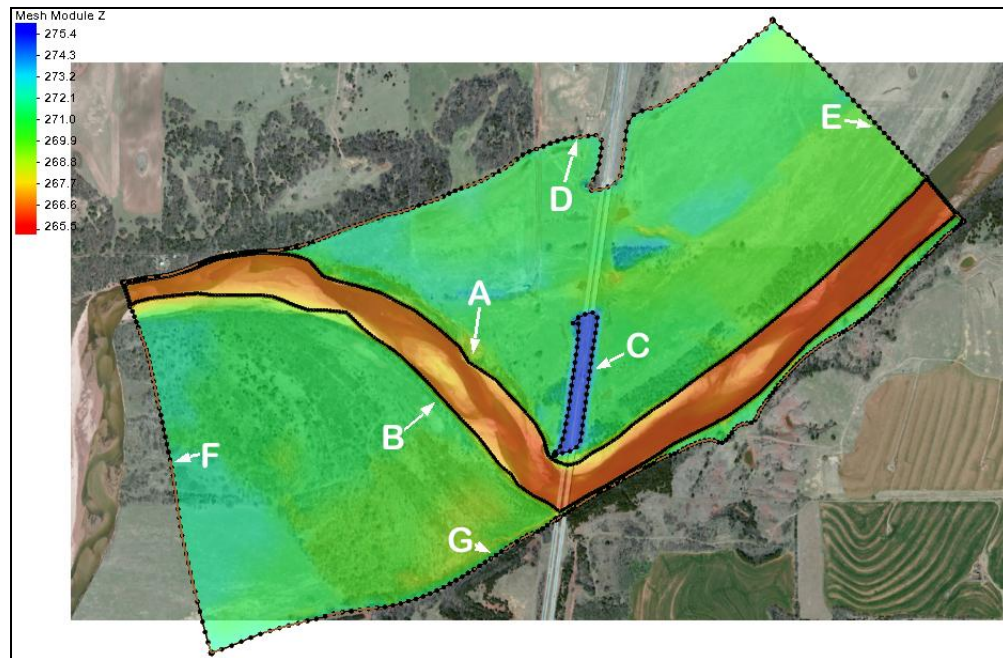


Figure 1 Starting project with arc labels

### 3 Using Specified Spacing

Specified spacing redistribution was demonstrated in the “Map Module” tutorial. This method redistributes the arcs based on a desired distance.

To review redistributing vertices using specified spacing, follow these steps:

1. Turn on and select the “ Segment Spacing” map coverage to make it active.
2. Using the **Select Feature Arc**  tool, click on the Arc D at the top of the mesh boundary.
3. Select *Feature Objects* | **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.

This dialog shows information about the feature arc segments and vertex spacing.

4. In the *Specify* option drop down, select the “*Specified Spacing*” option.
5. In the box next to *Average spacing*: enter “50”.

This will increase the distance between vertices and make it so that the mesh has fewer details at the edge of the boundary.

6. Click **OK** to close the *Redistribute Vertices* dialog and redistribute the vertices along the arc.

Notice the vertices have been reduced and evenly spaced along the arcs (Figure 3).

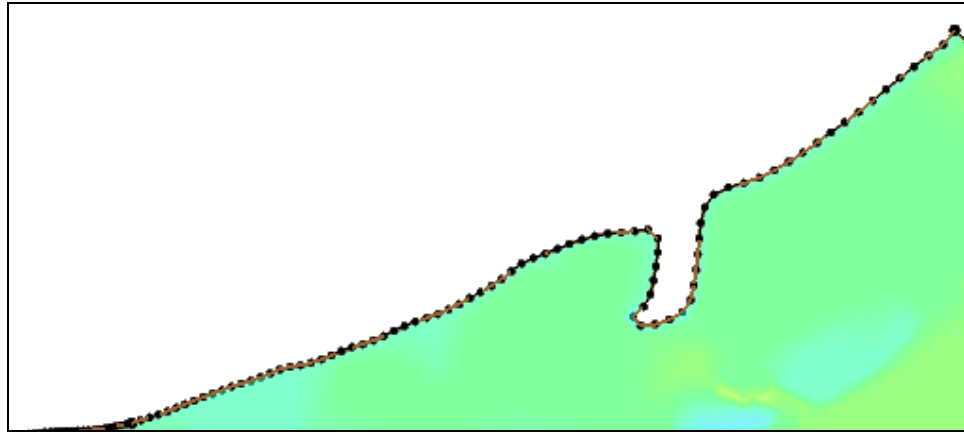


Figure 2 Arc before redistribution

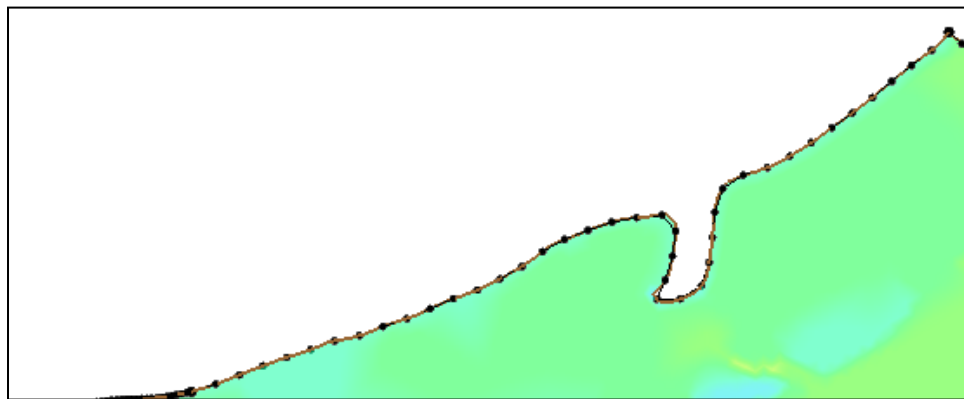


Figure 3 Arc after redistribution to reduce the number of vertices

### 3.1 Using a Bias

A bias option can be specified to adjust how SMS determines the spacing. The bias will adjust the spacing towards one end of the arc.

1. Using the **Select Feature Arc**  tool, click on Arc D at the top of the mesh boundary.
2. Select *Feature Objects* | **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
3. Change the *Bias (0.01-100.0)*: option to be "5.0".
4. Click **OK** to close the *Redistribute Vertices* dialog and redistribute the vertices along the arc.

Notice the vertices have shifted to be closer spaced at the start of the arc (Figure 4) and farther apart at the end of the arc. Adjusting the 2<sup>nd</sup> *Bias* option would have spaced the vertices closer at the end of the arc. When both biases are used, the spacing in the middle of the arc will be the widest.

5. Turn off the  "Segment Spacing" coverage before continuing.

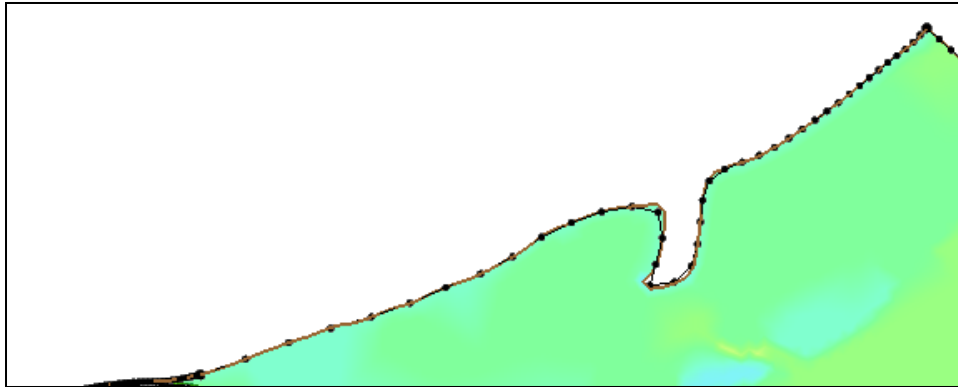


Figure 4 Redistribution using a bias

## 4 Using the Number of Segments

Similar to redistributing arcs using specified spacing, arcs can also be redistributed using a specified number of segments. This redistribution method functions similar to the specified spacing method.

With this method, a specific number of segments are used for the selected arc(s). SMS will distribute the vertices to equally space the vertices to create the desired number of segments.

This process can be done using the *Redistribute Vertices* dialog. However, redistributing the number of segments on an arc can also be done using the *2D Mesh Polygon Properties* dialog. Doing it this way allows previewing how redistributing the vertices will affect the mesh.

1. Turn on and select the  "Segment Number" map coverage to make it active.
2. Using the **Select Feature Polygon**  tool, select the channel polygon.
3. Right-click on the channel polygon and select **Polygon Attributes** to open the *2D Mesh Polygon Properties* dialog.
4. Set the *Mesh Type* to "Patch (quadrilaterals)".
5. To see how the patch would currently be generated, click the **Preview Mesh** button.
6. Click **OK** on the warning dialog that appears.

The current mesh has errors in it in part because of how the vertices on the channel arcs are distributed. Because of this, a mesh preview cannot be generated. To fix this:

7. Using the **Select Feature Arc**  tool in the dialog, select the top channel arc.
8. Under *Arc Options*, select *Distribute*.
9. In the box next to *Distribute*, enter the value "100". This will reduce the number of segments along the arc to 100.
10. Repeat steps 7–8 with the bottom channel arc.
11. Click **Preview Mesh** to see how the mesh will change.

Notice the vertices have been redistributed along the channel making a cleaner mesh (Figure 5). If multiple arcs are selected when using the number of segments method, the value will be applied to each arc individually, not divided between arcs.

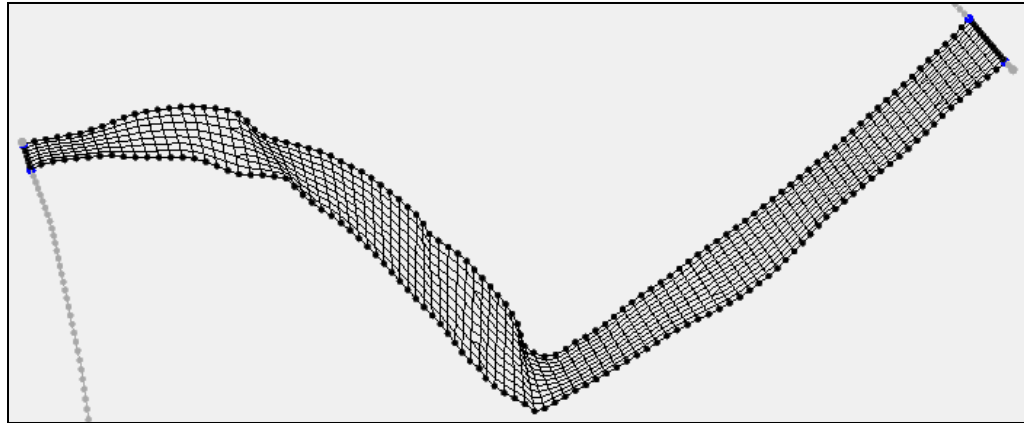


Figure 5 Patch after redistributing vertices

12. When done, click **OK** to close the *2D Mesh Polygon Properties* dialog.

Notice that the vertices have been redistributed along the channel.

13. Turn off the “ Segment Number” map coverage before continuing.

## 5 Using Min/Max Spacing

The “Begin/end Spacing” method defines the vertices spacing at the two ends of a single arc independently, with SMS smoothly grading the segment lengths between them along the arc. The spacing will follow the direction of the arc, so the vertices will be closer where the arc starts and further apart towards the end of the arc.

1. Turn on and select the “ Begin End” map coverage to make it active.
2. Using the **Select Feature Arc**  tool, click on Arc E on the right side of the mesh boundary.
3. Select *Feature Objects* | **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
4. In the *Specify* option drop down, select the “Begin/end spacing” option.
5. Enter “10” for *Begin length*.
6. Enter “50” for *End length*.
7. Click **OK** to close the *Redistribute Vertices* dialog and redistribute the vertices along the arc.

Notice the vertices are closer at the start of each arc following the begin spacing value and gradually grow further apart reaching the end spacing by the end of the arc (Figure 7). The redistribution was done for each arc separately even though two arcs were selected.

8. Turn off the “ Begin End” map coverage before continuing.

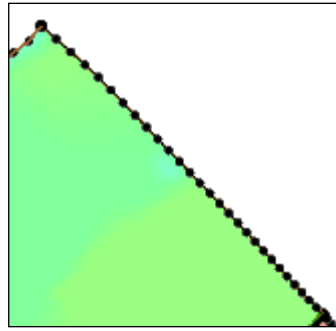


Figure 6 Before redistribution

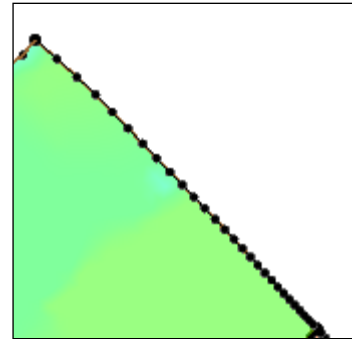


Figure 7 After Min/Max redistribution

## 6 Using a Source Arc

Often an arc needs to have vertices distributed to align with vertices on an existing arc. This is important when applying a patch mesh type to a polygon.

To redistribute vertices using a source arc, follow these steps:

1. Turn on and select the  "Source Arc" map coverage to make it active.
2. Using the **Select Feature Arc**  tool, click on Arc B on the lower side of the channel.
3. Note the ID number of the selected arc.
4. Hold the *Shift* key down and click on Arc A on the upper side of the channel.
5. Select *Feature Objects* | **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
6. In the *Specify* option drop down, select "Source Arc".
7. Set the *Source Arc* to match the ID of Arc B.
8. Set the *Target Arc* to match the ID of Arc A.
9. Click **OK** to close the *Redistribute Vertices* dialog and redistribute the vertices along the arc.
10. If a warning dialog appears, click **OK**.

The arcs will still be highlighted, because they are still selected. Notice vertices have been changed on the target arc to more closely match those on the source arc.

To see how the source arc redistribution will change how the mesh is generated, do the following:

11. Using the **Select Feature Polygon**  tool, select the channel polygon.
12. Right-click on the channel polygon and select **Polygon Attributes...** to open the *2D Mesh Polygon Properties* dialog.
13. Set the *Mesh Type* to "Patch (quadrilaterals)".
14. To see how the mesh would be generated, click the **Preview Mesh** button.

15. Notice the patch shows the target arc vertices aligning with the source arc vertices as seen in Figure 8.

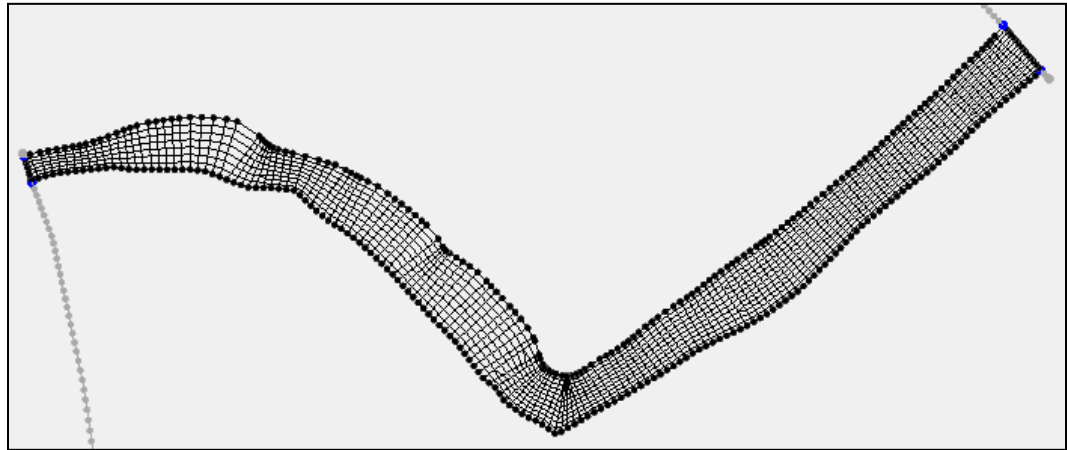


Figure 8 Redistribution using a source arc

16. When done, click **OK** to close the *2D Mesh Polygon Properties* dialog.
17. Turn off the  "Source Arc" map coverage before continuing.

## 7 Using a Size Function

Vertices can also be redistributed to match data in a size function dataset. In this example, a size function has already been created using the *Dataset Toolbox*.

To do this:

1. Turn on and select the  "Size Function" map coverage to make it active.
2. Using the **Select Feature Arc**  tool, select Arc D at the top of the mesh boundary.
3. Right-click anywhere in the graphics window and select **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
4. In the *Specify* option drop down, select "Size Function".
5. Click the **Options** button to open the *Interpolate Source and Options* dialog.
6. For the *Source dataset*, select "Project\Scatter Data\Cimarron\Gradient Size 5to50 Smooth 0.5".
7. Click **OK** to close the *Interpolation Source and Options* dialog.
8. Click **OK** to close the *Redistribute Vertices* dialog.

The vertices along the arcs will be redistributed to match the smoothed size function dataset (Figure 9).



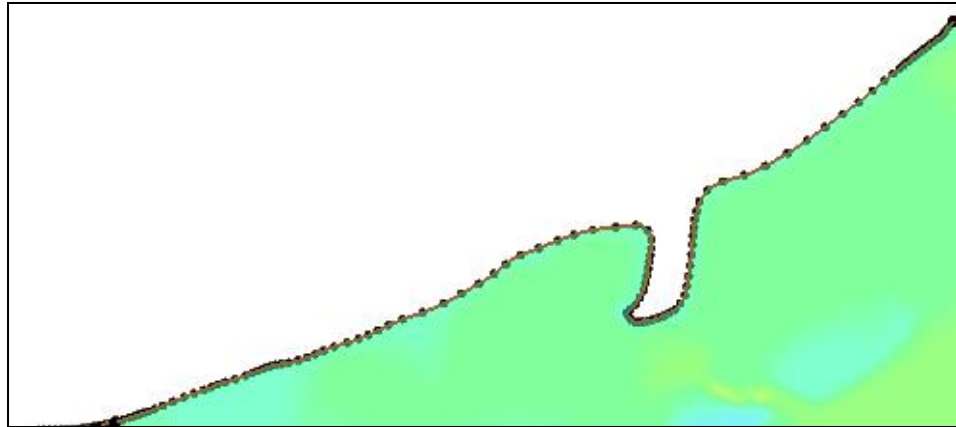


Figure 9 Redistribution using a size function

## 8 Using Insert/Filter Vertices

The Insert/filter vertices method provides a way to modify the vertices of an arc without independently redefining the spacing along it. Rather than replacing the existing vertex distribution, this method works on top of the existing vertex distribution, using two controls.

The Number insertion vertices field adds new vertices between every existing pair of adjacent vertices. The Filter number field removes redundant vertices from the arc

These two controls can be used independently or together, enabling the model to first filter out unnecessary vertices and then insert new ones at a more uniform density.

To do this:

1. Turn on and select the  "Insert filter" map coverage to make it active.
2. Using the **Select Feature Arc**  tool, select Arc G at the bottom of the mesh boundary.
3. Right-click anywhere in the graphics window and select **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
4. In the *Specify* option drop down, select "Insert/filter vertices".
5. In the *Filter Number* box enter "2".
6. Press **OK** to exit the *Redistribute Vertices* dialog.  
Notice how the vertices are more spread out.
7. Right-click anywhere in the graphics window and select **Redistribute Vertices...** to open the *Redistribute Vertices* dialog.
8. In the *Number insertion vertices:* box, enter "1".
9. Click **OK** to close the *Redistribute Vertices* dialog.  
Notice how the vertices become closer together again.

## 9 Conclusion

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If desired, each coverage can be converted to a mesh. The effects of the vertex redistribution can be seen in the resulting mesh. Each mesh could then be compared to the mesh that was included in the project file.

This concludes the “Redistributing Vertices” tutorial. Feel free to continue experimenting with the SMS interface.