Topology

Topology studies the property of remaining unchanged when geometric objects (point, line and region objects) were bended or stretched. You can ensure that the digital geometric objects follow the specified topology relations by topology processing and checking the simple datasets (point, line and region datasets) and modifying the topology errors. It is the basic that construct region dataset, network dataset or conduct the network analysis.

There are two methods of topology processing provided by SuperMap: topology processing only check the line datasets (or the network datasets) and the system will modify the topology errors in dataset; The other is topology checking. The topology checking provides detail rules to check the point, line and region datasets. System will save the topology errors to the new result dataset. Users can modify compared to the result dataset.

Build the topology relation and conduct the topology processing and checking according to the specified rules. You can ensure the quality of the data. The topology relation can be used to find the lines that aren’t connected properly, the unclosed polygons and other topology errors in digital map. Modify the incorrect spatial relation by constructing topology relations, and you can ensure the integrity and accuracy of data.

SuperMap provides 7 methods in topology processing and 29 methods in topology checking. In SuperMap, the topology errors include two types: the topology errors of geometric objects in single dataset or in different datasets; The topology errors in geometric objects contain self intersection, self overlap and the correlations in three (include intersection, overlap, containing, connecting and other spatial relations).

Main Contents:

The Topology Processing Rules

Introduce the rules and usages used in topology processing, including removing pseudo nodes, redundant vertices, duplicated lines, extending undershoots, merging adjacent endpoints and intersecting arcs in detail.

The Topology Checking Rules

Introduce the rules and usages used in topology processing in detail. The topology checking provides 6 rules for point datasets, 13 rules for line datasets and 10 rules for region datasets, which can meet all the topology checking requirements.
The Topology Preprocessing

Introduce the methods and steps for topology preprocessing in details, including inserting vertices, snapping to vertices, changing directions of polygons, etc.

Line Topo Processing

Introduce how to check and fix for the line datasets or network datasets.

Topology Checking

Introduce how to use the topology rules provided by SuperMap to check the geometric objects that don't fit the rules in or between datasets.

Construct Region with Topo

Introduce how to use line datasets or network datasets to construct region datasets.

Construct Network with Topo

Introduce how to use line datasets or network datasets to construct network datasets.

Topology Processing Rules

There may be errors in the collecting of editing of spatial data. For example, one node or line been digitalized twice, and fissures, intersections and misclosure polygons may occur when collecting neighbouring region objects, these errors may lead topology errors like pseudo nodes, redundant nodes, overshoots, duplicated lines, thus the topological relationship between the spatial data captured is different from the real situation, this may affect the data processing and analysis and the quality and availability of the data. Besides, there may be lots of topological errors and they are too small to identify, it is not easy to remove them manually, so it is needed to fix these redundancy and errors by topology processing.
Topology processing is to repair the topology errors or avoid the creating of topology error, including checking and repairing. Topology processing including clean pseudo nodes, clean redundant vertices, clean duplicate lines, clean overshoots, clean undershoots, merge adjacent ends and intersect arcs.

In this software, topology processing is used mainly on line datasets, you can used the line dataset processed to construct region dataset or network dataset, you can also use “Dataset topology checking” functionality to perform the detailed topology checking operation. The operations involved including validate line topology, construct network and construct region.

The use of the topology processing rules are introduced below.

1. **Clean pseudo nodes**

   Pseudo nodes are the points that only connects to two arcs.

   When pseudo nodes have no use, you can perform the clean pseudo nodes operation and merge the two arcs connected by the pseudo node to one arc.

   As shown in fig1, Point A and B are meaningless pseudo nodes and need to be cleaned, the result are shown in fig2 below.
2. **Clean redundant vertices**

Due to operation error, several nodes which have the same meaning and close to each other may exist on a line object, only one node is correct, other nodes are redundant nodes.

If two or more nodes on a line object whose distance are less than or equal to the specified node tolerance, only one node will be retained after topology processing, other points will be removed as redundant nodes. The node tolerance can be set in the attribute window of the dataset.

As shown in fig1 below, on the line object a, the distance between point A and point B is less than the node tolerance, when perform topology processing, point A will be removed as redundant point, point B will be retained, the result is as fig2.

Meanwhile, on line object a, the distance between point C and D is also less than the node tolerance, when perform topology processing, point C will be removed as redundant point, the result is shown as fig2. Since the end point of line object b (C') overlap with node C, and the two line objects do not have a common intersection point, line object b will not be affected when perform topology processing. To remove point C and merge point C' and D when perform topology processing, it is needed to select Redundant Vertices and Intersect Arcs.

The similarities and differences of pseudo nodes and redundant node:
Removing redundant points and pseudo nodes are all removing redundant points.
Redundant points must be remove, but pseudo node needs to be reserved sometimes.
A redundant point is created by double-clicking when drawing a line object, a redundant point is a continuous and complete line object, a pseudo node is created when merge endpoints or snap lines, it connects two line objects.
Redundant nodes are node, that is the points on the line object except the endpoints; pseudo nodes are the end points.

3. Clean duplicate lines

When do not consider the direction of the line object, if all the nodes on two line objects coincide by order (that is has the same coordinate) or the distances between the nodes are less than the tolerance of the node, the two line objects duplicate with each other, one of the line objects is called duplicate line. The node tolerance can be set in the attribute window of the dataset which contains the line object.

To avoid the creating of polygon region objects whose area is 0 or very small in the creating of topology polygon, only one of the two duplicate line objects will be retained.

As shown in fig1 below, line object AB duplicate with line object A’B’, A’B’ is the duplicate line, to distinguish the duplicate line, A’B’ is shown in an other color. After the topology processing, A’B’ is removed, the result is shown as fig2.

![Figure 1](image1)

![Figure 2](image2)

4. Clean overshoots

If an endpoint of one arc is not connected to any other arc, this endpoint is called a dangle point. A line with a dangle point is called a dangle line. Overshoots is the line object whose dangle part is short.

When the Clean Overshoots is checked, it is needed to set the tolerance extent for this rule, when the dangle part is less than the tolerance extent set, the dangle part will be deleted after the topology processing. The extent of the Clean Overshoots tolerance should be less than the 100 times of the dangle tolerance, the default tolerance will be used if set as
0. The dangle tolerance can be set in the attribute window of the dataset which contains the line object.

As shown in fig1 below, line objects a, b and c all contains dangle lines, a and b are overshoots and the length of the dangle part is less than the tolerance set, they will be removed after topology processing; but the length of the dangle part of c is larger than the tolerance set, it will be retained. The result is shown in fig2 below.

5. **Extend undershoots**

If an endpoint of one arc is not connected to any other arc, this endpoint is called a dangle point. A line with a dangle point is called a dangle line. Undershoots is the line object whose dangle part is long.

When the Extend Undershoots is checked, it is needed to set the tolerance extent for this rule, when the distance for the undershoots to extend to the nearest line object is less than the tolerance extent set, the undershoots will be extended to intersect with the nearest line object after the topology processing. The extent of the Extend Undershoots tolerance should be less than the 100 times of the dangle tolerance, the default tolerance will be used if set as 0. The dangle tolerance can be set in the attribute window of the dataset which contains the line object.

As shown in fig1, line object a, b and c are all undershoots, the distances for a and b to extend to the nearest line object d is less than the tolerance, after the topology processing, the two undershoot will be extended to line d; the distance for c to extend to the nearest line object d is larger than the tolerance, it will be retained after the topology processing. The result is shown as fig2 below.
6. **Merge Adjacent Ends**

When the distances between multiple arc end points are less than the node tolerance, these end points are called adjacent end points. After topology processing, these adjacent end points will be merged as one end point. The node tolerance can be set in the attribute window of the dataset which contains the line object.

Note that if there are only two end points whose distance are less than the node tolerance, a pseudo node will be created after merge.

As shown in fig2 below, there are adjacent end points at A and B, they will be merged to one node after topology processing. A pseudo node will be created at A, and the Clean Pseudo Node operation is needed.

7. **Intersect Arcs**

When one or more line objects intersect with each other, the Intersect Arcs operation can be used to break the line object at the intersection and create several simple line objects that connect to each other.

By performing the Intersect Arcs operation, you can avoid missing region objects or creating overlap region objects when creating topological polygons.

As shown in fig1 below, line object a and b intersect, and both of them intersect with line object c, after topology processing, these three line
object will be broken at the intersections and several line objects will be created, meanwhile, three nodes are created: A, B and C, the result is shown as fig2 below:

![Figure 1 and Figure 2]

In a real world application, you may need to retain the intersection relation of some intersecting line objects, and can’t break them at the intersection. You can set a field in the attribute table of the dataset which contains the line object representing whether to break the line, and controls whether to break the line object by input a filter expression.

- **Nonbroken Objects**: After setting the filter expression, the system will not break the line objects that meet the expression. Click the button on the right, the SQL expression dialog box appears, you can input expression in it. Please refer to SQL Expression Dialog Box.
- **Nonbroken location**: Select the point datasets listed in the dropdown list on the right to determine Nonbroken location. Determines whether to break line objects by checking whether the distance between the point object in the selected point dataset and the adjacent line object is within the tolerance.

If you do not set nonbroken objects, all the line objects will be used in the intersect arcs operation; if you do not set nonbroken locations, all the line objects will be used in the intersect arcs operation; when both nonbroken objects and nonbroken locations are set, the system will process the union.

**Note**

1. You can select different topology processing option group according the condition.
2. It is recommended to select Intersect Arcs before topology processing.
3. When perform topology processing, the source dataset will be changed, to retain the data of the source dataset, it is needed to backup dataset before topology processing.
4. The intersect arcs operation will create a real node, but merge adjacent ends may create pseudo nodes, so it is needed to perform clean pseudo node after merging adjacent ends.
5. The result of topology processing will be affected by the setting of the tolerance, it is recommended to use the default value.
Topology Rules

Validate Topology is to return objects in point, line, region dataset that violate the specified topology rule. Validate Topology is usually performed before data editing and topology analysis.

In SuperMap, there are 6 topology rules defined for point datasets, 14 for line datasets, and 10 for region datasets. Besides, there are 5 kinds of topology rules that can be used for different types of topology rule.

The topology rules used for point, line and region dataset and the rules used for multiple kinds of datasets are introduced below.

The rules used for point dataset

The following rules are supported only by point dataset.

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must Be Covered By Line</td>
<td>Requires that points in a point dataset fall on the lines in a line dataset. The points can overlap with the endpoints of the lines.</td>
<td><img src="image1" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Be Covered By Boundary Of Region</td>
<td>Requires that points must fall on the boundaries of region objects in a region dataset. The points that are not on any boundary in the region dataset will be returned in the result dataset as errors.</td>
<td><img src="image2" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Be Properly Inside Polygons</td>
<td>Requires that points must fall within regions in a region dataset. The points that are not contained by any region in the region dataset will be returned in the result dataset.</td>
<td><img src="image3" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Be Covered By Endpoint Of Line</td>
<td>Requires that points in a point dataset must be covered by the endpoints of lines in a line dataset. The points in the point dataset that are not covered by any endpoint will be returned in the result dataset.</td>
<td><img src="image4" alt="Illustration" /></td>
</tr>
<tr>
<td>No Identical Points</td>
<td>Requires that points in the same point dataset not overlap. Duplicate points will be returned in the result dataset as errors.</td>
<td><img src="image5" alt="Illustration" /></td>
</tr>
<tr>
<td>Point No Contained By Polygon</td>
<td>Requires that points in the point dataset not contained by the interior of any region in the region dataset. The points contained by the interior of any regions will be returned in the result dataset as errors.</td>
<td><img src="image6" alt="Illustration" /></td>
</tr>
</tbody>
</table>

The rules used for line dataset

...
The following rules are supported only by line dataset.

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must Not Intersect With Each Other</td>
<td>Requires lines in one line dataset must not intersect with lines in another line dataset. The intersections will be returned in the result dataset as errors. Error dataset type: Point dataset.</td>
<td><img src="image1" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Not Intersect Within The Line Itself</td>
<td>Requires that line objects in the same line dataset not cross or overlap each other. Lines can share endpoints. The intersections will be returned in the result dataset as errors. Error dataset type: Point dataset.</td>
<td><img src="image2" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Not Self Overlap</td>
<td>No self overlap in the same line dataset. Requires that line objects not overlap themselves. The self overlapped segments will be returned in the result dataset. Error dataset type: Line dataset.</td>
<td><img src="image3" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Not Have Dangles</td>
<td>Requires that a line object must touch lines from the same dataset at both endpoints; otherwise it will be an error. Endpoints that are not shared will be returned in the result dataset. Error dataset type: Point dataset.</td>
<td><img src="image4" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Not Have Pseudo nodes</td>
<td>Requires that each shared endpoint must have at least three lines connected to it; otherwise it will be an error. Shared endpoints that have only two lines connected to it will be returned as errors in the result dataset. Error dataset type: Point dataset.</td>
<td><img src="image5" alt="Illustration" /></td>
</tr>
<tr>
<td>Must Not Overlap With</td>
<td>Requires that a line from one dataset not overlap with line(s) in another dataset. The self overlapped segments will be returned in the result dataset. Error dataset type: Line dataset.</td>
<td><img src="image6" alt="Illustration" /></td>
</tr>
</tbody>
</table>
### The rules used for region dataset

The following rules are supported only by region dataset.
<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must Not Overlap</td>
<td>Requires that the interior of regions in one region dataset not overlap. The regions can share edges or vertices. This rule is used when an area can not belong to two or more regions. The self overlapped segments will be returned in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Must Not Have Gaps</td>
<td>Requires that no gaps exist in a single region or between adjacent regions. That is, all regions must form a continuous surface. An error will always exist on the perimeter of the surface. You can just ignore this error. Use the rule on data that must completely cover an area. The gaps will be returned in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Must Not Overlap With</td>
<td>Requires that the interior of regions in one dataset not overlap with the interior of regions in another dataset. Regions of the two datasets can share edges or vertices or be completely disjointed. This rule is used when an area can not belong to two separate datasets. It is useful for combining two mutually exclusive systems of area classification, such as land cover type. The self overlapped segments will be returned in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Must Be Covered By Regions Of</td>
<td>Requires that a region in one dataset must share all of its area with regions in another dataset. It is used when a region of one type, such as a province, should be completely covered by regions of another type, such as counties. Lines or line segments in other dataset that are not covered by any line in the other dataset will be returned as errors in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Must Be Contained By</td>
<td>Requires that regions of one dataset must be contained within regions of another dataset. Regions may share edges or vertices. That is to say, any area defined in the contained dataset must be covered by an area in the covering dataset. The regions in the first dataset that are not contained within any region of the other dataset will be returned in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Boundary Must Be Covered By Lines Of</td>
<td>Requires that boundaries of regions in a region dataset must be covered by lines in a line dataset. The boundaries of the regions that are not covered by any line in the line dataset will be returned in the result dataset. Error dataset type: Line dataset.</td>
<td></td>
</tr>
<tr>
<td>Area Boundary Must Be Covered By Boundary Of</td>
<td>Requires that boundaries of regions in one region dataset be covered by boundaries of regions in another region dataset. The boundaries of the regions that are not covered by any line in the line dataset will be returned in the result dataset. Error dataset type: Line dataset.</td>
<td></td>
</tr>
<tr>
<td>Contains Point</td>
<td>Requires that any region in a region dataset must contain at least one point from a point dataset. Points must be within the area, not on the boundary. The regions that contain no point will be returned in the result dataset. Error dataset type: Region dataset.</td>
<td></td>
</tr>
<tr>
<td>Region No Overlap On Boundary</td>
<td>Requires that boundaries of regions in one region dataset not overlap any boundary of regions in another region dataset. The portions of the boundaries in the first region dataset that are overlapped by any boundary in the other region dataset will be returned in the result dataset. Error dataset type: Line dataset.</td>
<td></td>
</tr>
<tr>
<td>Region Inside No Acute Angle</td>
<td>Checks whether there is an acute angle less than the given angle in the region dataset. If the angle formed by three consecutive points in the region is less than the given angle which is less than 90 degrees, it is judged to be the acute angle. The acute angle vertex is the error point, and it will be generated into the result dataset as a topology error. Error dataset type: Point dataset.</td>
<td></td>
</tr>
</tbody>
</table>
The rules used for several kinds of dataset

The following topology rules applies to one or more types of datasets, including point, line or region dataset or the combination of them.

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line or region must be single object.</td>
<td>Checks whether line or region dataset itself has complex object (a object that contains one or more subobjects, such as parallel lines). The complex objects will be returned in the result dataset as errors. Error dataset type: Line dataset or region dataset.</td>
<td><img src="image1" alt="Illustration" /></td>
</tr>
<tr>
<td>The Vertex Distance Has to be greater than the tolerance.</td>
<td>Checks whether the the distance between the node of line, point, region dataset itself or in two types of datasets are less than or equal to the given tolerance. The points whose distance are not larger than the tolerance will be returned in the result dataset as errors. Error dataset type: Point dataset. Note: This rule is get by extend the topology preprocessing operation. It is recommended not the check the &quot;Topology Preprocessing&quot; when check the topology rules, otherwise the errors find by this rule will be repaired automatically and you can get the expected result.</td>
<td><img src="image2" alt="Illustration" /></td>
</tr>
<tr>
<td>There must be point on the intersection of lines.</td>
<td>Check line, region dataset itself or the two datasets, whether the intersection of lines has a node, and whether the node exists on both of the two lines; two lines objects with the end points connect to each other is considered as the correct topological relationship. Note: If the two lines connect, it won’t break the rule. If there are no node at the intersection, the system will compute the node and return it as topology error in the result dataset. Error dataset type: Point dataset. Note: This rule is get by extend the topology preprocessing operation. It is recommended not the check the &quot;Topology Preprocessing&quot; when check the topology rules, otherwise the errors find by this rule will be repaired automatically and you can get the expected result.</td>
<td><img src="image3" alt="Illustration" /></td>
</tr>
<tr>
<td>The nodes must match with each other.</td>
<td>Check line, region dataset itself or two datasets, line dataset and point dataset, point dataset and region dataset, whether there are line objects (or polygon border) within the tolerance of the current node, and there are corresponding nodes on the line match with it. For the mismatching points, the system will calculate the location of the matching point, the matching point will be returned as topology errors to the result dataset. Error dataset type: Point dataset. Note: This rule is get by extend the topology preprocessing operation. It is recommended not the check the &quot;Topology Preprocessing&quot; when check the topology rules, otherwise the errors find by this rule will be repaired automatically and you can get the expected result.</td>
<td><img src="image4" alt="Illustration" /></td>
</tr>
<tr>
<td>Line or the border of region do not has redundant vertex.</td>
<td>Checks whether the line object or region border itself in line dataset or region dataset has redundant nodes, that is there can’t be colineation nodes between the two node, the colineation nodes are redundant nodes. Redundant nodes will be returned as errors in the result dataset. Error dataset type: Point dataset.</td>
<td><img src="image5" alt="Illustration" /></td>
</tr>
</tbody>
</table>

2D Topology Preprocessing

Introduction

Before carrying out the topology check, it’s needed to carry on the topology preprocessing operation, through the preprocessing to adjust the problem data in the tolerance range. Without topology preprocessing, there may be an error in the
result of the topology check. 2D topology preprocessing methods include: the insertion of nodes, nodes and nodes snapping, and the adjustment of the polygon direction.

**Basic Steps**

Click Data>Topology Preprocessing>2D Topology Preprocessing to prompt the 3D Topology Preprocessing dialog.

![2D Topology Preprocessing Dialog](image)

**Figure: 2D Topology Preprocessing Dialog**

1. Click Add button to add the dataset to be processed.

**Toolbar buttons**

- Button : click the Add button to add a record in the list box for recording the datasets that need to be processed.
- Button : Click the Select All button to select all the records in the list box.
- Button : Click the Select Inverse button to inversely select the records in the list box. The original selected records turn into unselected state while the original unselected records turn into selected state.
2. The following parameters are required to set:
   - **Tolerance**: The tolerance value for the topology preprocessing, which is a distance value, it means that in the range of the value, all the nodes or (and) lines are considered to be identical. For example, if the distance between a line's node and another line's node is in the tolerance range, it is considered that the two nodes coincide; if the distance between a line's node and a point object is in the tolerance range, it is considered that point is on the line. When the distance between the nodes and (or) lines is less than the tolerance value, the topology preprocessing is performed.

   The default tolerance value is related to the coordinate system of the dataset, for details please see [Tolerance Description](#).

   - **Node Snap**: the nodes within the tolerance range are caught together (the nodes that are snapped are set to the same 2D coordinates), where the meaning of "node" is to the point object and the nodes on lines and regions. After checking the Node Snap check box, you can select a dataset in Reference Data which is taken as the reference points for the snap. After the snapping the points within the tolerance range on the lines or regions will be removed. The effect is shown in the picture below.

   ![Before and After Node Snap](image)

   **Before the topology preprocessing After the topology preprocessing**

   - **Insert between vertex and arc**: If you check the item, it will preprocess the topology errors according to the tolerance value, that is, insert the foot point on the line for the point to the line when the distance between the point and the line is less than the tolerance.

   ![Before and After Insert](image)

   **Before the topology preprocessing After the topology preprocessing**

   - **Insert for arc intersections**: If the check box is checked, insert a node on the arc intersection or overlapped point while keeping the data direction. The processing result is as shown below.
Adjust polygon direction: If the check box is checked, the boundary direction of the region dataset is adjusted to the standard direction, that is, the outer boundary is clockwise, the hole is counter clockwise, the island is clockwise, as shown below.

Note

This function may change the spatial position of the source dataset. Please make a copy before it.

3D Topology Preprocessing

Introduction

Before carrying out the topology check, it's needed to carry on the topology preprocessing operation, through the preprocessing to adjust the problem data in the tolerance range. Without topology preprocessing, there may be an error in the result of the topology check. The 3D topology preprocessing provides the node capture processing method, which only supports 3D line datasets currently.
Basic Steps

Click Data>Topology Preprocessing>3D Topology Preprocessing to prompt the 3D Topology Preprocessing dialog.

**Figure: 3D Topology Preprocessing Dialog**

1. Click Add button to add the 3D line dataset to be processed.

   **Toolbar buttons**

   - **Button**: click the Add button to add a record in the list box for recording the datasets that need to be processed.
   - **Button**: Click the **Select All** button to select all the records in the list box.
   - **Button**: Click the **Select Inverse** button to inversely select the records in the list box. The original selected records turn into unselected state while the original unselected records turn into selected state.
   - **Button**: click the Delete button to remove one or more records selected from the list box.

2. The following parameters are required to set:

   - **Tolerance**: The tolerance value for the topology preprocessing, which is a distance value, it means that in the range of the value, all the nodes or (and) lines are considered to be identical. For example, if the distance between a line's node and another line's node is in the tolerance range, it is considered that the two nodes
coincide; if the distance between a line's node and a point object is in the tolerance range, it is considered that point is on the line. When the distance between the nodes and (or) lines is less than the tolerance value, the topology preprocessing is performed.

The default tolerance value is related to the coordinate system of the dataset, for details please see Tolerance Description.

- Node Snap: the nodes within the tolerance value are put together (the nodes that are put together are set to the same 2D coordinates), where the meaning of "node" is the point object or nodes of the lines or regions.

After checking the Node Snap check box, you can select a dataset in Reference Data which is taken as the reference points for the snap. After the snapping the points within the tolerance range on the lines or regions will be removed. The effect is shown in the picture below.

3. Click OK to perform the operation.

**Note**

This function may change the spatial position of the source dataset. Please make a copy before it.

**Validate Line Topology**

**Introduction**

Validate and repair the topology of line dataset and network dataset.
Basic Steps

1. In the Data tab, click Validate Line Topology in the Topology group.
2. The Line Dataset Topo processing dialog box appears, as shown below.

![Figure: Line Dataset Topo processing dialog box](image)

3. Select the source dataset to perform topology processing, it can be a line dataset or network dataset.
   - Datasource: Select the datasource that contains the line dataset or network dataset.
   - Dataset: Select the the line dataset or network dataset to perform topology processing.
4. Topology processing options

   Topology processing options includes clean pseudo nodes, clean redundant vertices, clean duplicate lines, clean overshoots, clean undershoots, merge adjacent ends and intersect arcs, you can select the proper rules according to your needs. For more details about the topology processing rules, please refer to Topology Processing Rules. When perform topology processing, the system will validate the line dataset with the selected topology rules and repair the topology errors.

   Click the Advanced button, the Advanced Settings dialog box appears, you can set the nobreak line and the tolerance.
Intersect Arcs: set nobreak line parameter, the lines meet the parameters will not be broken.

- Nonbroken Objects: After setting the filter expression, the system will not break the line objects that meet the expression. Click the button on the right, the SQL expression dialog box appears, you can input expression in it. Please refer to SQL Expression Dialog Box.

- Nonbroken location: Select the point datasets listed in the dropdown list on the right to determine Nonbroken location, Determines whether to break line objects by checking whether the distance between the point object in the selected point dataset and the adjacent line object is within the tolerance.

If you do not set nonbroken objects, all the line objects will be used in the intersect arcs operation; if you do not set nonbroken locations, all the line objects will be used in the intersect arcs operation; when both nonbroken objects and nonbroken locations are set, the system will process the union.

- Tolerance Settings: Overshoots tolerance is used for clean overshoots, Undershoot tolerance is used for clean undershoot and Fuzzy is used for other topology processing rules that need to check the distance between nodes. The default tolerance is the dataset tolerance of the source dataset.

If the topology error options are not list, the system will skip the error. To perform more detailed topology, please refer to Topology Check.

5. Click OK to perform topology processing operation for the selected line dataset.

The topology processing operation is done on the selected line dataset, no new result dataset will be created, a prompting interface "This operation will change the source data, continue?", to set you to decide whether to process to source data directly. You can backup the source data before performing the operation.
Note

To perform Remove Undershoot Dangles for line data, you must check the "Edges Intersect" option, to guarantee the accuracy of the operation.

Topology Checking

Introduction

It is used to check the objects that don't conform to the topology in point, line, region datasets and different datasets. And check that save the result to the GIS Dataset (the point, line and region datasets) or the CAD dataset.

Basic Steps

1. Click ribbon > "Data" tab > the "Check Topology" button in "Topology" group.
2. Eject the following "Check Dataset Topology" dialog box.

3. Users should set the following parameters

![Figure: The "Check Dataset Topology" dialog box]
Add Dataset

Add the dataset needs to check to the list. The list will display the related topology checking information of these datasets. The following will introduce the information each column represents, editable and usage.

- **Dataset**: The dataset needs to topology check.
- **DataSource**: The datasource that the dataset needs to topology check belongs to.
- **Topology Rule**: There are 35 rules for the topology checking. You can select the topology rules in the "Parameter Settings" dialog box. Please refer to Topology Checking Rules for more information.

**Instruction for Toolbar Button**

- **Add** button: Click "Add" button to add a record in the list box, which is used to record the dataset information needs to topology checking. After adding a record in the list box, the dataset and datasource to check will locate to the selected dataset and datasource in the workspace manager automatically. The topology rule will display the first rule supported by this dataset by default.
- **Select All** button: Click the "Select All" button to select all the records in the list box.
- **Select Inverse** button: Click the "Select Inverse" button to inverse the records in the list box.
- **Remove** button: Click the "Remove" button to remove one or multiple selected records.

**Parameter Settings**

It is used to set the parameters. See Topology Checking Rule for detailed description about topology rules.

- **Topology Rule**: It is the rule used to check the topology. The system will list all the topology rules that fit this dataset according to the dataset type. After selected a topology rule, the corresponding graph will be displayed in "Rule Description". It is convenient for users to know the rules.
- **Tolerance**: The tolerance used in topology checking and topology preprocessing, such as the distance between vertexes. The different topology rules should set the different tolerances and it is recommended to use the default tolerance. The tolerance unit is in accordance with the dataset unit.
- **Offset Angle**: This parameter is only used in the "line has no dangles" rule. It is used to set the tolerance of the angle of the segment.
- **Topology Preprocessing**: If check this box, the system will preprocess the dataset according to the tolerance. The tolerance can be set in "Tolerance". That is to say, all the points and lines are regarded as coincident in this range. You can save an point or line object as the right through topology preprocessing. Some topology rules have good effects after preprocessing. The topology preprocessing will recommend you to preprocess according to the dataset to check and the reference dataset.

Because this operation will change the dataset that participate in topology processing, ”The operation might change the dataset participating the topology validation.” will be displayed. If users don’t want to change is data, please backup before this operation.
- **Fix Topology Errors**: The system can fix the errors automatically. After selecting this option, the status of "Fix Topology Errors" will be checked. After checking this option, you can fix the dataset automatically at the same time.

The topology rules can be fixed automatically are as shown below:

<table>
<thead>
<tr>
<th>Topology Rule</th>
<th>Fix Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>line has no pseudo nodes</td>
<td>change the pseudo nodes into nodes, namely, merge the two lines that connected by pseudo nodes into one.</td>
</tr>
<tr>
<td>L/R has no redundant vertex</td>
<td>delete the redundant vertexes in line or region.</td>
</tr>
<tr>
<td>line not overlap line</td>
<td>if the line object in dataset to check overlaps with the line object in reference dataset, it will delete the superpositions in dataset to check.</td>
</tr>
<tr>
<td>line not self intersect</td>
<td>delete the self intersection in line object.</td>
</tr>
<tr>
<td>line not self overlap</td>
<td>delete the overlap in one of the line object.</td>
</tr>
<tr>
<td>vertex distance &gt; tolerance</td>
<td>Snap all the nodes in the tolerance range and merger into a node.</td>
</tr>
<tr>
<td>vertices must match</td>
<td>Add the matched nodes to the line object.</td>
</tr>
<tr>
<td>vertex exists at line intersect</td>
<td>Add the point in the intersection of two segments.</td>
</tr>
</tbody>
</table>

**Reference Data**

- **Datasource**: The datasource that the reference dataset belongs to, and the default is the datasource that the dataset to check belongs to.
- **Dataset**: The reference dataset used in topology checking. According to the different topology rules, some rules will use two datasets to check, such as "point should be in line". It needs a line dataset as the reference dataset; But some rules check in one dataset, such as "line has no overlap". You can only select the dataset to check.

**Result Data**

- **Datasource**: The datasource that the result dataset belongs to, and the default is the datasource that the dataset to check belongs to.
- **Dataset**: After selecting a topology checking record in the list box, you can set the result dataset name here. The default name is TopoCheckResult. The type of result dataset is related to the topology rule this record sets.
- **Save to Same Dataset**: If you check this box, save all the topology checking results in the list into a same dataset (CAD Dataset). The dataset name is the display name of current result dataset. If you don't check this box, users can set the result dataset name for every topology checking record.

4. "Closed when finished" dialog box: After checking this box, the "Check Dataset Topology" dialog box is closed automatically when the application finished the topology checking of all the records; Otherwise, don't close the dialog box automatically.

**Note**

If the self-intersection region objects exist in the data to be checked, it can't check the region with the rule of no gaps.
Construct Region by Topology

Introduction

Builds the region dataset with line dataset or network dataset by the topology processing.

Basic Steps

1. In the Data tab, click Construct Region in the Topology group.
2. The Construct Region with Line Dataset processing dialog box appears, as shown below.

3. Select the dataset to perform topology processing in the source data region, it can be a line dataset or network dataset.
   - Datasource: Select the datasource that contains the line dataset or network dataset which is used in the constructing.
   - Dataset: Select the the line dataset or network dataset to perform topology constructing.
   - Topology processing: Before perform the construct region operation, it is recommended to perform topology processing operation for the dataset. Repair the problem line objects (for example, have pseudo, redundant point, overshoots, duplicated lines, not merged adjacent end points) within the tolerance by topology processing.

![Construct Region with Line Dataset dialog box](image-url)
Split the intersection line objects at the intersection point. By topology processing, you can avoid creating redundant objects when constructing regions.

The following topology rules are enabled when checked Topology Processing, including clean pseudo nodes, clean redundant vertices, clean duplicate lines, clean overshoots, clean undershoots, merge adjacent ends and intersect arcs. You can select the proper rules according to your needs, for more details about topology rules, please refer to Topology Rules.

Click the Advanced button, the Advanced Settings dialog box appears, you can set the nobreak line and the tolerance.

Since this operation is done on the source dataset directly, a prompt “Note: The operation will modify the source data” will appear when you check it, if you don’t want to modify the source data, please backup before performing the operation.

When the Topology Processing is checked, the system will perform the topology processing operation before constructing region, including check and repair the topology error of the selected line dataset.

4. Set the name of the result region dataset and the location to save it.
   - Datasource: The datasource that contains the result dataset, it the datasource that contains the source dataset by default.
   - Dataset: The name of the result dataset. Note that when there are no enclosing regions in the line dataset used to create region, the count of objects in the result dataset will be 0.