Convex Edge

Layer operation

Selects edges dependent on the number of convex endpoints, edge length, angle of abutting edge, and length of abutting edge.

Usage

Basic syntax:

CONVEX EDGE ***layer endpoint_constraint*** [WITH LENGTH *edge_length_constraint*]

Detailed syntax:

CONVEX EDGE ***layer***
ANGLE1 ***angle_constraint*** [LENGTH1 *abut_length_constraint*]
ANGLE2 ***angle_constraint*** [LENGTH2 *abut_length_constraint*]
[WITH LENGTH *edge_length_constraint*]

Parameters

- ***layer***

  A required original layer, or a derived polygon or edge layer.

- ***endpoint_constraint***

  A required constraint in the basic syntax that specifies the number of endpoints (0, 1, or 2), which must lie at a convex corner for an edge to be selected. See "Basic Endpoint Specification" in the Description section.

  Note

  Constraints are listed in the "Constraint Notation" column of Table 2-2 in the topic "Constraints" on page 67. The notation is used for all constraints in the Convex Edge operation.

- **ANGLE1** ***angle_constraint*** **ANGLE2** ***angle_constraint***

  Required keywords in the detailed syntax that define abutting edge behavior. You must specify ANGLE1 and ANGLE2 with their respective constraints, which are interpreted in degrees measured between interior-facing sides of abutting edges.

- LENGTH1 *abut_length_constraint* LENGTH2 *abut_length_constraint*

  Optional keywords in the detailed syntax that specify the edge selection depends on the length of abutting edges at the endpoints defined by ANGLE1 and ANGLE2, respectively. The LENGTH1 and LENGTH2 keywords are specified with an associated *abut_length_constraint*. These constraints are interpreted in user units and apply to the edges that abut at the endpoints of a given edge.

- WITH LENGTH *edge_length_constraint*

  An optional keyword that specifies that output edges are limited in length to *edge_length_constraint*. The length is in user units.

Description

This operation has two syntaxes, basic or detailed. In the basic syntax, the operation creates a derived edge layer by selecting edges depending on the number of convex endpoints each edge has. Edge length, angle of abutting edges, and length of abutting edges are considered by using the detailed syntax.

This operation is not limited to selection of edges based purely on convexity. In most cases the convexity (or concavity) of the endpoints of edges is a by-product of the parameters you specify.

Both the basic and detailed specifications can include the WITH LENGTH optional keyword and the *edge_length_constraint*.

The differences between basic and detailed are discussed in the following sections.

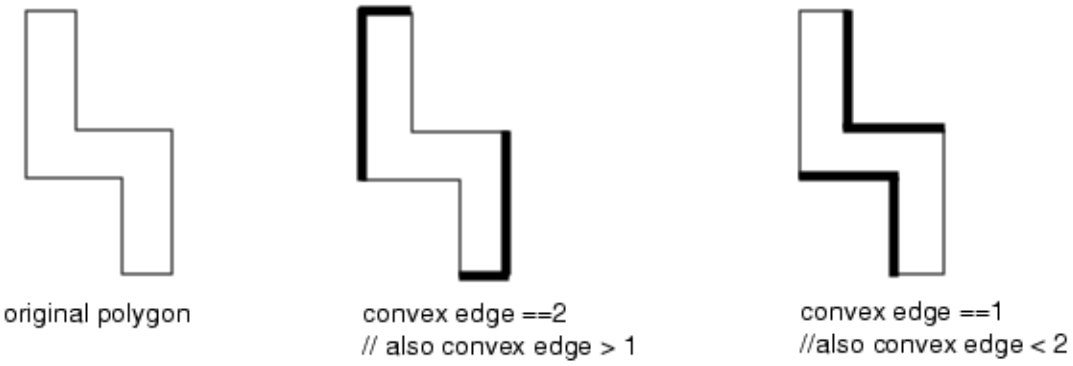
Basic Endpoint Specification

A basic endpoint specification includes a constraint indicating the number of convex corner endpoints (0, 1, or 2) for the edge to be selected. A convex corner must have an interior measure of less than 180 degrees.

- To select edges with two endpoints at convex corners, use == 2.
- To select edges with exactly one endpoint at a convex corner, use == 1.
- To select edges with no endpoints at convex corners (both corners are concave), use == 0.
- To select edges with at least one endpoint at a convex corner, use > 0.
- To select edges that do not have both endpoints at convex corners, use < 2.

Example constraints are shown in the following figure:

Figure 4-13. Convex Edge Simple Specification



Detailed Endpoint Specification

A detailed endpoint specification allows edge selection based upon the exact angles formed by abutting edges at each endpoint of a given edge. **ANGLE1** designates one endpoint and **ANGLE2** designates the other endpoint. Angle constraints which are < 180 degrees (measured internal to the polygon) are convex. Angle constraints which are > 180 degrees are concave.

LENGTH1 and LENGTH2 further specify edge selection based on the length of the abutting edges at the endpoints of a given edge. Length parameters are associated with **ANGLE1** and **ANGLE2**, respectively. If you do not specify LENGTH1 and LENGTH2 they default to the constraint >= 0.

Detailed endpoint specification selects edges with the following algorithm.

- Designate the endpoints of the edge as A and B.

The edge is selected if the status at endpoint A satisfies the **ANGLE1** and LENGTH1 constraints, and the status at endpoint B satisfies the **ANGLE2** and LENGTH2 constraints.

If the edge is not selected from the previous test, then:

- The edge is selected if the status at endpoint B satisfies the **ANGLE1** and LENGTH1 constraints and the status at endpoint A satisfies the **ANGLE2** and LENGTH2 constraints.

The tool does not select the edge if it does not meet the above requirements.

Derived Edge Input

The process of edge selection needs to be refined for a derived edge input layer. This is due to the possibility that abutting edges may not be present.

For basic endpoint specification, the number of convex endpoints is counted as before. However, if an abutting edge is absent, the endpoint is not counted. This edge is then selected if the number of convex endpoints passes the associated ***endpoint_constraint***.

For detailed endpoint specification, the angle at an endpoint where there is no abutting edge is defined as 0 degrees. This value can be used since edges cannot meet at an angle of 0 degrees in a layer representing merged data. The length of the abutting edge (which is missing) is defined to be 0 user units. For example, if the **ANGLE1** constraint includes 0, an endpoint with no abutting edge satisfies the **ANGLE1** constraint.

Examples

Example 1

The following example selects all metal1 edges which have both endpoints at a convex corner:

```
x = CONVEX EDGE metal1 == 2
```

Example 2

The following example selects all metal edges which have one endpoint at a convex corner and length less than 3 user units:

```
y = CONVEX EDGE metal == 1 WITH LENGTH < 3
```

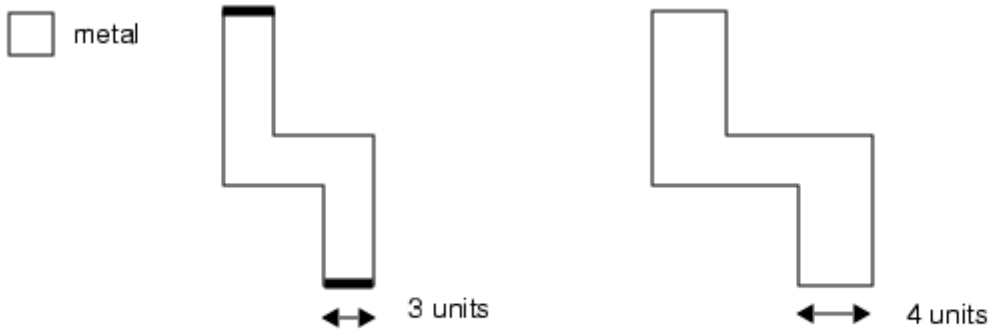
Example 3

The following example selects all edges from metal where one endpoint is at a convex corner with an abutting edge length of 3 or more, and the other endpoint is at a concave corner with an abutting edge length of any value.

```
z = CONVEX EDGE metal ANGLE1 < 180 LENGTH1 >= 3 ANGLE2 > 180
```

Example 4

The following example selects all edges from metal where both endpoints are at 90-degree convex corners and the edge itself has length greater than 2 and less than 4.




```
w = CONVEX EDGE metal ANGLE1 == 90 ANGLE2 == 90 WITH LENGTH >2 <4
```

Example 5

The following example selects all edges from metal where both endpoints are at 90-degree convex corners and at least one abutting edge has a length less than 3.

```
u = CONVEX EDGE metal ANGLE1 == 90 LENGTH1 < 3 ANGLE2 == 90
```

Example 6

The following example derives edge layers having gate edges inside diffusion, based upon the number of abutments with other gate edges inside diffusion.

```
gate_edges = poly INSIDE EDGE diff
```

```
// 0 abutments
gate_abut0 =  CONVEX EDGE gate_edges ANGLE1 == 0 ANGLE2 == 0

// 1 abutment
gate_abut1 =  CONVEX EDGE gate_edges ANGLE1 == 0 ANGLE2 > 0

// 2 abutments
gate_abut2 =  CONVEX EDGE gate_edges ANGLE1 > 0  ANGLE2 > 0

// 0-1 abutments
gate_abut01 = CONVEX EDGE gate_edges ANGLE1 >= 0 ANGLE2 == 0

// 1-2 abutments
gate_abut12 = CONVEX EDGE gate_edges ANGLE1 >= 0 ANGLE2 > 0
```