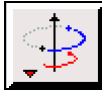### Revolve Vertices

The **Revolve Vertices** operation (`edge create revolve` command) creates circular arc edges or helixes by revolving existing real and/or non-real vertices about a specified axis. The command requires the following input parameters:

- One or more vertices to be revolved

- The axis of revolution

- The angle through which the vertices are revolved about the axis

- (*Optional*) The height of a helix-shaped edge

Specifying Vertices to Be Revolved

When you create an edge by revolving a vertex, GAMBIT sweeps the vertex through the specified angle of revolution to create a circular arc edge (see Figure 2-47). (NOTE: If you revolve a non-real vertex, GAMBIT makes a real, in-place copy of the non-real vertex and revolves the real copy to create the edge.) The vertex specified for revolution (or real, in-place copy) constitutes the start endpoint of the created edge, and the edge sense points in the direction of revolution.
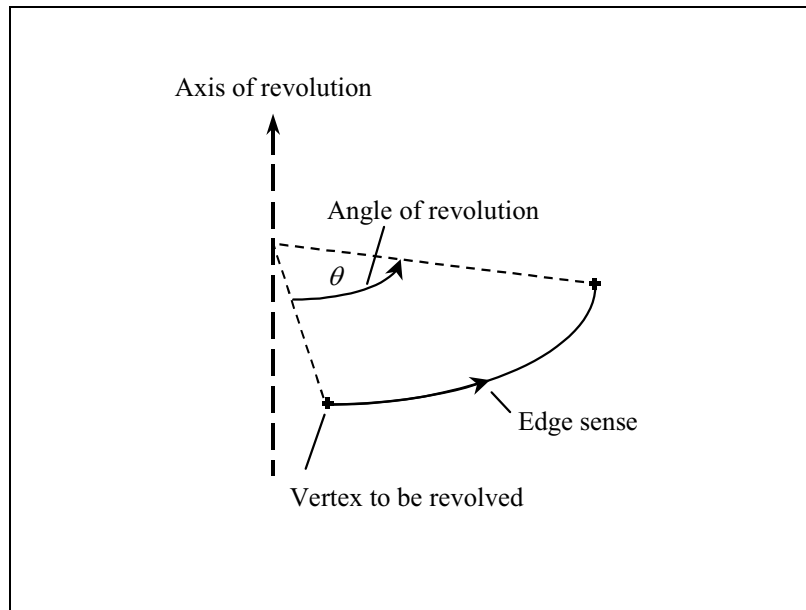

Figure 2-47: **Revolve Vertices** operation

You can specify any number of real and/or non-real vertices for the **Revolve Vertices** operation. As noted above, if you specify a non-real vertex, GAMBIT copies the virtual vertex to create a real vertex at the same location and revolves the real vertex to create a real edge. As a result, the **Revolve Vertices** command always creates a real edge regardless of the geometry type of the specified vertex.

Specifying the Axis and Angle of Revolution

To specify the axis of revolution, you must define the axis by means of the **Vector Definition** form. For a description of the **Vector Definition** form and its operation, see "Using the Vector Definition Form" in Section 2.1.4. The conventions regarding the angle of revolution for the **Revolve Vertices** operation are identical to those described in "Rotating an Entity" in Section 2.1.4.

Specifying the Height

If you input a value for the **Height** specification on the **Revolve Vertices** form, GAMBIT creates the circular arc edge in the shape of a helix with the specified height. As an example of the effect of the **Height** specification, consider the arc edges shown in Figure 2-48.
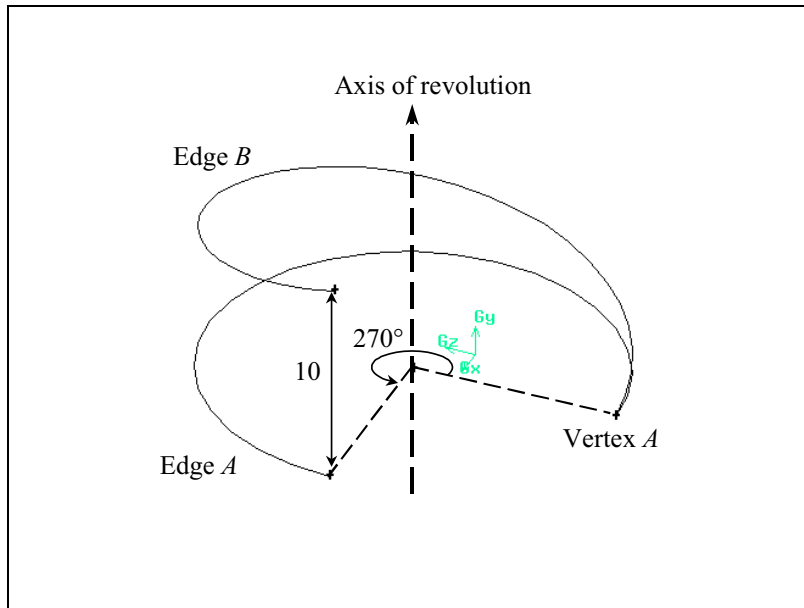

Figure 2-48: Effect of **Height** specification

Both of the edges shown in the figure are created by revolving vertex *A* through an angle of 270° about an axis aligned with the *y* coordinate axis. Edges *A* and *B* represent the arc edges created using **Height** specifications of 0 and 10, respectively. Edge *A* is a circular arc edge that lies in the *z-x* plane. Edge *B* is in the shape of a partial helix.

Using the Revolve Vertices Form

To open the **Revolve Vertices** form (see below), click the **Revolve Vertices** command button on the **Geometry/Edge** subpad.

The **Revolve Vertices** form includes the following specifications.

Vertices ⬆	specifies one or more real vertices to be revolved.
Angle	specifies the angle through which the vertices are revolved.
Axis:	includes two components:

- A Define command button that allows you to define the axis around which the edge is to be revolved

- The coordinates of the start and end points for a vector defining the axis of revolution

Height	specifies the height for the creation of a helix-shaped edge.
Label	specifies a label for the new face. (See Section 2.1.1.)

Project Edges on Face

The **Project Edges on Face** operation (`edge create project` command) creates real edges that represent the projection of existing real or non-real edges onto the surface of an existing face.

When you execute the **Project Edges on Face** command, GAMBIT creates a set of one or more real edges the shapes of which represent the projection of specified (*projection*) edge(s) onto the surface of a specified (*target*) face (see Figure 2-49). The shape of any edge created by the operation follows the contours of the target face.
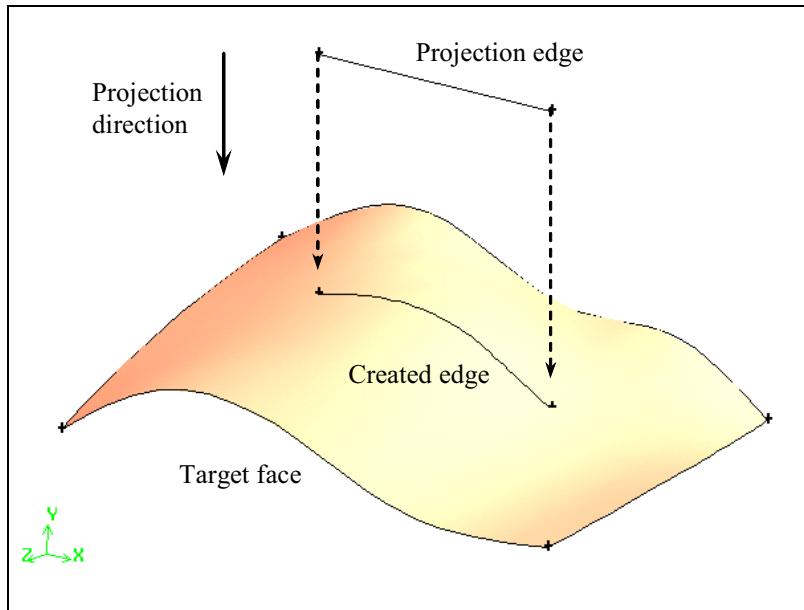

Figure 2-49: **Project Edges on Face** operation

If the projection of an edge extends beyond the boundaries of the target face, GAMBIT truncates the created edge at the face boundaries. In addition, if the projection of an edge crosses the face boundaries more than once, GAMBIT creates multiple edges from the operation (see Figure 2-50).
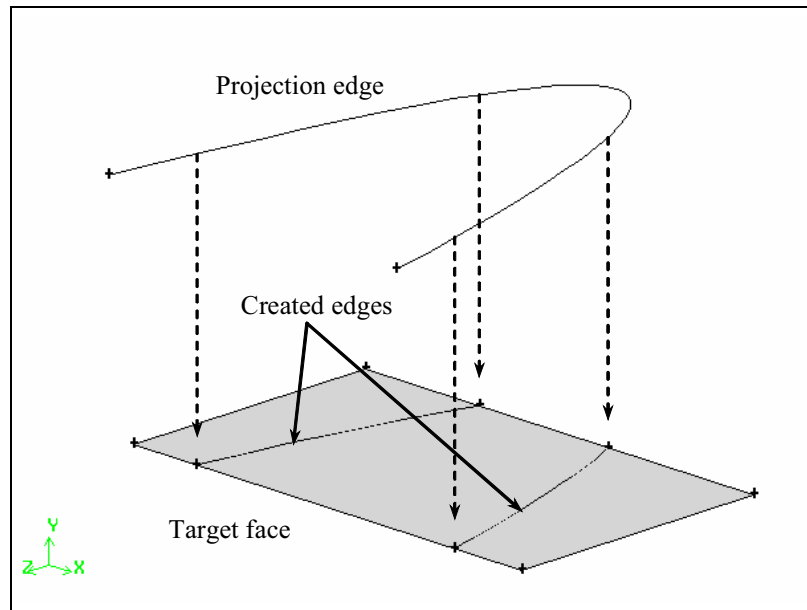
Figure 2-50: **Project Edges on Face**—creation of multiple edges

Projection Specifications

The **Project Edges on Face** command includes the following specifications:

- Projection edges and target face
- Projection direction
- Split face option

Specifying the Projection Edges and Target Face

The projection edges and target face can represent any combination of real and/or non-real entities. For example, it is possible to project a real edge onto a virtual face or a set of real and non-real edges onto a real face. Regardless of the geometry types of the specified edges and face, however, the **Project Edges on Face** operation creates *real* edges on the surface of the target face.

Specifying the Projection Direction

GAMBIT provides two options for specifying the direction in which the edges are to be projected:

- Closest distance

- Direction

If you specify the Closest distance option, GAMBIT projects each point on the projection edge onto its closest point on the target face. If you specify the Direction option, you can define the projection direction by means of the **Vector Definition** form. (For a description of the **Vector Definition** form and its use, see "Using the Vector Definition Form" in Section 2.1.4.)

Figure 2-51 illustrates the effect of the direction option on the results of a simple projection operation involving a single edge. In this case, the projection edge is a circular arc edge aligned with the *z-x* coordinate plane, and the target face is a square planar face tilted at an angle of 30° with respect to the *z-x* coordinate plane.
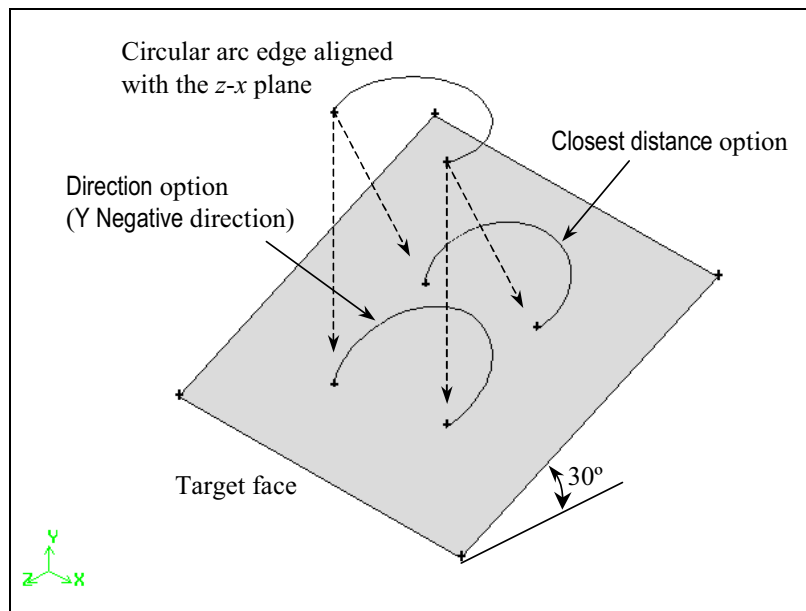

Figure 2-51: **Project Edges on Face**—effect of direction options

If you select the Closest distance option, GAMBIT projects each point on the circular arc edge in a direction normal to the planar surface. If you select the Direction option and specify Y Negative as the projection direction (by means of the **Vector Definition** form), GAMBIT projects each point on the edge in the –*y* direction.

Specifying the Split face Option

If you specify the Split face option when projecting a set of edges onto a face, GAMBIT uses the created edge(s) to split the target face. For example, if you project a curved edge onto a planar rectangular face as shown in Figure 2-52 and specify the Split face option, GAMBIT splits the target face and creates two virtual faces from the edge-project operation. In this case, the projection of the edge extends beyond the face boundaries; therefore, the face is fully split to create two new faces.
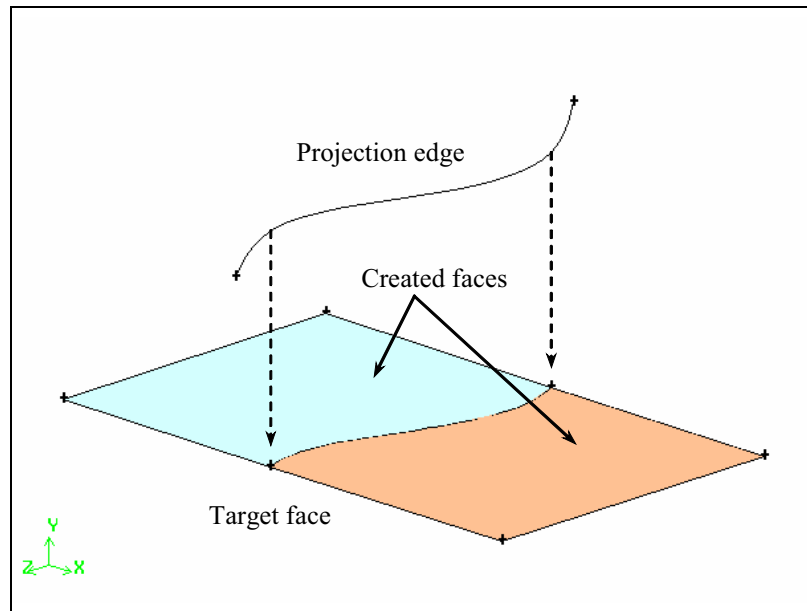

Figure 2-52: **Project Edges on Face**—effect of Split face option

If the projection of an edge does *not* extend beyond the target face boundaries, the Split face option creates a single virtual face with a dangling edge (see Figure 2-53).
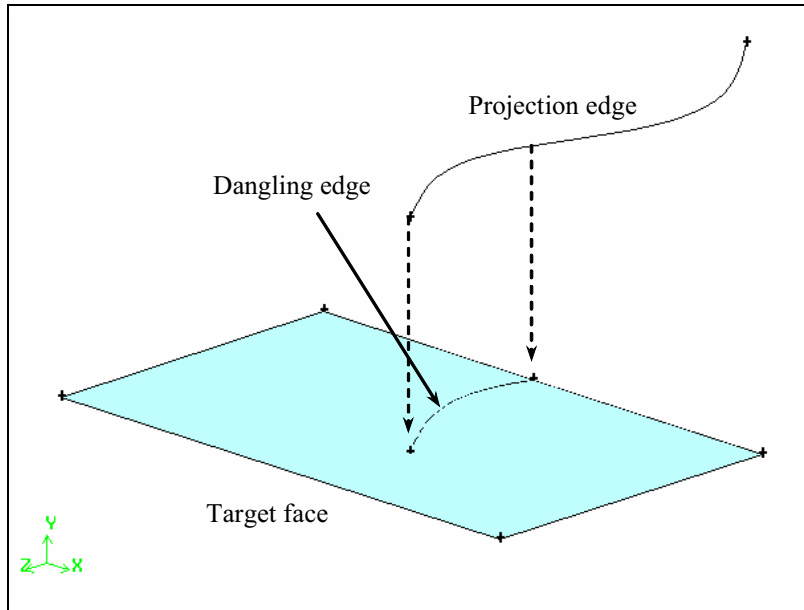
Figure 2-53: **Project Edges on Face**—effect of Split face option, dangling edge

Using the Project Edges on Face Form

To open the **Project Edges on Face** form (see below), click the **Project Edges on Face** command button on the **Geometry/Face** subpad.

The **Project Edges on Face** form includes the following specifications.

| Edges ↑ | specifies the set of edges to be projected. |

| Face ↑ | specifies the target face that constitutes the projection surface. |

| ● Closest distance | specifies that GAMBIT projects each point on the projection edge(s) onto its closest point on the target face. |

| ● Direction | specifies that GAMBIT projects each point on the projection edge(s) in a user-specified direction. When you select this option, GAMBIT activates a Define command button that opens the **Vector Definition** form. |

| ☑ Split face | uses the created edge(s) to split the target face. |

| Label | specifies a label for the new edge. (See Section 2.1.1.) |