Chapter 1.
Remove Faces Component

Component: *Model Topology

The Remove Faces Component (REM), in the rem directory, supports removal of faces and other topological elements after a local operation and heals the resulting body with the remaining faces.

REM simplifies a body by removing redundant faces and mending the gap that is left, when this is geometrically possible. If it is not possible, the model is left unchanged and an error is raised. The body's shells and lumps are corrected at the end of the operation, if they have been split. The API function api_remove_faces is used to perform this operation.

REM has the following limitations:

- The body must be manifold and solid.
- Some remaining faces may shrink if necessary, but not so far as to let edges between them degenerate to zero length. The mending process must be entirely within the faces adjacent to those removed.
- No checks are made to see if the faces grown intersect with other non-growing faces in the model. Checks that the growing faces intersect with one another is not rigorously done between unconnected regions of growing faces.
- Mixed convexity blended vertex faces are generally not removable in isolation, as the underlying blends cannot combine to mend the gap. Such vertices can, however, be removed along with one or more of their underlying blends.

The following test harness examples illustrate the some of the functionality of REM.

Removing a Vertex Blend

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Test Harness Example

```
block b1 width 50 depth 50 height 50
blend b1 pick edge 0 0 0 1 –1 0 round 10.0
blend b1 pick edge 0 0 0 0 –1 1 round 10.0
blend b1 pick edge 0 0 0 1 0 1 round 10.0
blend b1 pick vertex 0 0 0 1 –1 1 setback 20
blend b1 pick vertex 0 0 0 1 –1 1 fix
draw
remove_faces b1 pick 0 0 0 1 –1 1
draw
```

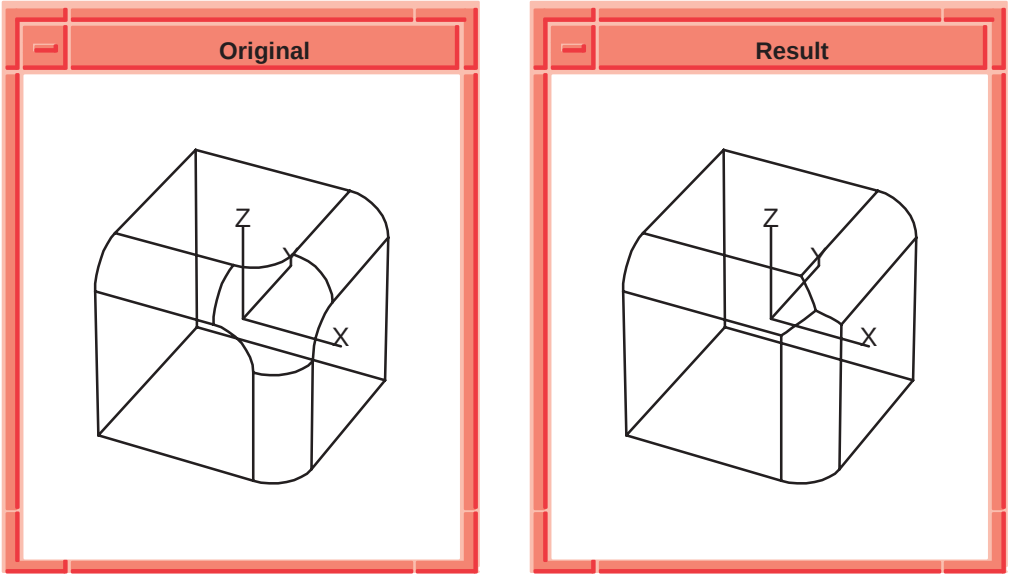

Figure 1-1. Removing a Vertex Blend

Shells or Lumps Separating

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Shells and lumps may be split into two or more lumps when faces are removed. Shells of opposite solidity to the original are deleted. Faces left infinite are also removed; e.g., planar faces with no edges.

Test Harness Example

```
prism b1 sides 5 radius 25 height 50 top 0
move b1 by 0 0 –26
copy b1 as b2
rotate b2 by 180 about y
unite b2 with b1
cylinder b3 radius 15 height 100
unite b3 with b1
draw
remove_faces b1 pick 0 0 0 1 0 0
draw
```

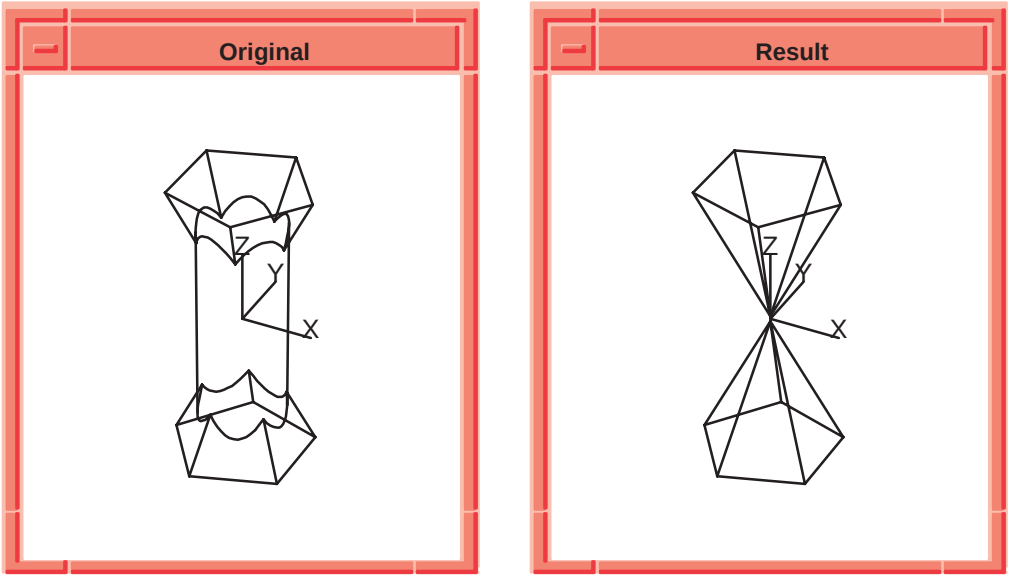

Figure 1-2. Shells Separating

Using the Bounding Box

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The user supplied bounding box must be large enough to contain the final grown remaining faces. As the box is used to limit surface–surface and curve–surface intersections, and curve or surface extensions, the smaller the box, the better the performance. The box default is twice the size of the original body box. This may be too small on bodies with acute angles between remaining faces.

Test Harness Example

```
prism b1 sides 10 radius 25 height 50 top 10
draw
remove_faces b1 top boxlow –50 –50 –50 boxhigh 50 50 100
draw
```

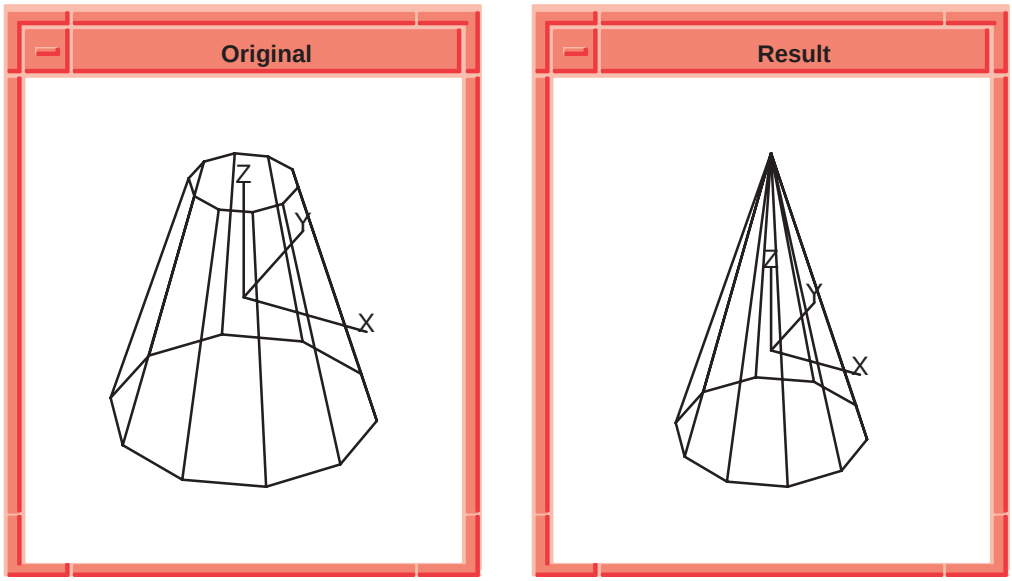

Figure 1-3. Using the Bounding Box