

Extract and Rebuild Algorithm Specification

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1. INTRODUCTION

This document describes the background of Extract and Rebuild algorithm. This algorithm allows extracting a set of sub-shapes from the main shape.

2. DESCRIPTION OF ALGORITHM

This operation allows extraction of some sub-shapes from a shape. The behavior of the algorithm is different depending on the extracted shape type, orientation and context of this shape with respect to its ancestors.

2.1 SHAPES TO BE EXTRACTED

Table 1 illustrates the behavior of the algorithm for forwarded and reversed shapes to be extracted:

Shape to be extracted	Context	Expected result
Compound	Single object	Operation is not allowed
	Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the parent Compound after extraction.
Compsolid	Single object	Operation is not allowed
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Solid	Single object	Operation is not allowed
	Part of Compsolid	<ul style="list-style-type: none"> NbSolids > 1: Compsolid NbSolids = 1: Solid NbSolids = 0: Null shape Where NbSolids is the number of solids left in the Compsolid after extraction.
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Shell	Single object	Operation is not allowed
	Outer bound of Solid	<ul style="list-style-type: none"> NbHoles > 1: List of shells NbHoles = 1: The Shell NbHoles = 0: Null shape Where NbHoles is the number of shells (holes) left in the Solid after extraction.
	A hole in Solid	Solid without hole
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Face	Single object	Operation is not allowed

	Part of Shell	<ul style="list-style-type: none"> NbFaces > 1: Shell or list of shells if remaining faces are not connected NbFaces = 1: Shell NbFaces = 0: Null shape Where NbFaces is the number of faces left in the Shell after extraction.
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Wire	Single object	Operation is not allowed
	Outer bound of Face	<ul style="list-style-type: none"> NbHoles > 1: List of wires NbHoles = 1: The Wire NbHoles = 0: Null shape Where NbHoles is the number of wires (holes) left in the Face after extraction.
	A hole in Face	Face without hole
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Edge	Single object	Operation is not allowed
	Part of Wire	<ul style="list-style-type: none"> NbEdges > 1: Wire or list of wires if remaining edges are not connected NbEdges = 1: Wire NbEdges = 0: Null shape Where NbEdges is the number of edges left in the Wire after extraction.
	Seam or degenerated on Face	Operation is not allowed
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.
Vertex	Single object	Operation is not allowed
	Part of Edge	Null shape
	Part of Compound	<ul style="list-style-type: none"> NbShapes > 1: Compound NbShapes = 1: The shape itself NbShapes = 0: Null shape Where NbShapes is the number of shapes left in the Compound after extraction.

Table 1. Forward and Reversed Shape Extraction

The behavior of extraction algorithm for internal or external shapes is presented in the Table 2:

Shape to be extracted	Context	Expected result
Shape	Single object	Operation is not allowed
	Part of Other Shape	Other Shape without extracted shape or Null Shape if it becomes empty after extraction.

	Part of Compound	<ul style="list-style-type: none"> • NbShapes > 1: Compound • NbShapes = 1: The shape itself • NbShapes = 0: Null shape <p>Where NbShapes is the number of shapes left in the Compound after extraction.</p>
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Table 2. Internal and External Shape Extraction

2.2 ANCESTORS OF EXTRACTED SHAPES

Basing on above described behavior, if the shape (child) is extracted, its ancestors (parents) can be:

- Removed;
- Replaced by shapes of lower type (e.g. a face can be replaced by a list of wires);
- Modified;
- Replaced by several shapes of the same type.

If parent shapes are removed, grand-parents are modified according to extraction rules described in the Table 1 and Table 2. The same behavior takes place for the case of replacement by shapes of lower type. However, replacements are considered as single shapes that are added to the final result.

All possible transformations of grand-parent shapes due to modified parents or replaced by several shapes of the same type are defined in the Table 3:

Modified Parent	Context	Expected result
Wire (Edge extracted)	Outer bound of Face	<p>If there are hole wires in the Face it is necessary to:</p> <ol style="list-style-type: none"> 1. Get the list of edges from holes; 2. Remove edges shared with other parts of the model from this list; 3. Create wires from the remaining edges. <p>The result is the list of created wires + Modified parent. If there are no holes the result is Modified parent.</p>
	A hole in Face	Face without hole + Modified parent.
	Part of Compound	Compound with Modified parent.
Face (Wire extracted)	Part of Shell	Shell with Modified parent.
	Part of Compound	Compound with Modified parent.
Shell (Face extracted)	Outer bound of Solid	<p>If there are hole shells in the Solid it is necessary to:</p> <ol style="list-style-type: none"> 1. Get the list of faces from holes; 2. Remove faces shared with other parts of the model from this list; 3. Create shells from the remaining faces. <p>The result is the list of created shells + modified parent. If there are no holes the result is Modified parent.</p>
	A hole in Solid	Solid without hole + Modified parent.
	Part of Compound	Compound with Modified parent.
Solid (Shell extracted)	Part of Compsolid	Compsolid with Modified parent.
	Part of Compound	Compound with Modified parent.
Compsolid	Part of Compound	Compound with Modified parent.

Table 3. Modification of grand-parents due to modified parents

The order of extraction is the following:

1. Extraction of all Compsolids
2. Extraction of all Solids
3. Extraction of all Shells
4. Extraction of all Faces
5. Extraction of all Wires
6. Extraction of all Edges
7. Extraction of all Vertices