CADdoctor® SX Product Configuration

**CADdoctor® SX Basic Packages**
- CADdoctor SX / Trans
  - 3D Data Translation (Geometry Check & Heal)
- CADdoctor SX / FEM
  - 3D Data Translation (Geometry Check & Heal)
- CADdoctor SX / Mold
  - 3D Data Translation (Geometry Check & Heal)
- CADdoctor SX / Reverse Engineering
  - 3D Data Translation (Geometry Check & Heal)

**CADdoctor SX Plus2 Bundle Packages**
- CADdoctor SX / TransPlus2
- CADdoctor SX / FEMPPlus2
- CADdoctor SX / MoldPlus2
- CADdoctor SX / Reverse Engineering
  - 3D Data Translation (Geometry Check & Heal)

**Optional Products**
- Geometry Simplification
- Reverse Engineering
- Quality Check for Mold Manufacturing

**Standard Function**
- IGES
- IGES
- STL

**Optional Function**
- Geometry Simplification, Geometry Verification, Geometry Deformation,
  Batch (for Multiple file conversion), Polygon Extension,
  Reverse Engineering, Quality Check for Mold Manufacturing

**Product Configuration**
- CADdoctor SX / Trans
  - 3D Data Translation (Geometry Check & Heal)
  - IGES and STEP I/O
- CADdoctor SX / FEM
  - 3D Data Translation (Geometry Check & Heal)
- CADdoctor SX / Mold
  - 3D Data Translation (Geometry Check & Heal)
- CADdoctor SX / Reverse Engineering
  - 3D Data Translation (Geometry Check & Heal)

**Standard Format I/O Add-on**
- Parasolid Add-on
- ACIS Add-on
- JT Add-on

**Direct CAD Import Add-on**
- CATIA V5 Import Add-on
- CATIA V4 Import Add-on
- NX (UG) Import Add-on
- Pro/E Import Add-on

**Direct CAD Export Add-on**
- CATIA V5 Export Add-on
- CATIA V4 Export Add-on

**Plus2 Bundle Packages**
- Includes 3D Data Translation (Geometry Check & Heal) and any two of the following:
  - IGES and STEP I/O
  - Parasolid Add-on
  - ACIS Add-on
  - JT Add-on

**Package Options**
- 3D Data Translation
  - Check
  - Heal
- Simplification
  - Feature Removal
  - Shrink Wrap
- Polygon Handling
- Reverse Engineering
- Quality Check for Molding
- Geometry Verification

- Trans / TransPlus2
- FEM / FEMPPlus2
- Mold / MoldPlus2
- Reverse Engineering

**N/A**
**Elysium’s Cutting Edge Technology**

**Realizing 3D Translation**

The smallest of an error hidden in 3D data is a major impediment in effectively using 3D data. The Elysium geometry interoperability technology condensed in CADdoctor provides highly reliable data translation and advanced 3D processing features. Adopted and highly praised by Renault F1 team, Elysium cutting edge technology brings unprecedented value to 3D data.

**Heighened Technology with Incredible Accuracy**

Automatic error healing is the key to maximizing 3D data. When an error is found through Product Data Quality (PDQ) validation, repairing in the original CAD system would be ideal. However, it is not very practical because the process can be very labor intensive, and the same errors can persist. Healing requires sophisticated geometry interoperability. As an example, for a high-precision CAD system, there is no problem with closing a gap using a tiny element. But on the other hand, it is considered poor quality, even useless data in a lower-precision CAD system. Elysium healing closes gaps by extending adjacent surfaces, at an accuracy of 0.001mm. Even for an example, for the most frequently used CAD system, the feature tree cannot be relied upon and operation must proceed strictly by using the geometry. Elysium geometry optimization provides advanced editing functionality utilizing geometry and topology in order to support 3D data editing for maximum utilization.

**Adherence to Geometry Interoperability**

When leveraging 3D data, editing, such as change to a FEM model or adding mold elements may be required. This type of editing requires work on the various CAD data using explicit operation. In these circumstances, the feature tree cannot be relied upon and operation must proceed strictly by using the geometry. Elysium geometry optimization provides advanced editing functionality utilizing geometry and topology in order to support 3D data editing for maximum utilization. As an example, for the most frequently used detection and removal of fillets, free-form fillets are supported and full arc form is not required. Elysium’s unique approximation operation, arc determination, and algorithms which determine continuity with periphery elements recognizes fillet areas very accurately including gradually changed fillets and corner fillets. Upon fillet removal, if a face is missing due to overlapping fillets, Elysium’s advanced technology regenerates the missing face using information such as boundary lines.

**Sustained through Tight Partnership with CAD Vendors**

When translating CAD data, it is important to devise ways to accommodate the characteristics of each CAD system. An example would be mathematical representation of a ridge line of a solid model which is different depending on the CAD system. Elysium examines the representation and makes a precise adjustment to the geometry based upon the intended target CAD system. Elysium has formed technical partnerships with all major CAD vendors in order to handle various CAD data in the most efficient and effective way. These relationships allow Elysium to become fully versed in the CAD data structure and API (Application Programming Interface), provide high quality 3D data, and to quickly support the latest releases of CAD software.

Elysium concentrates on maximizing 3D data by providing practical, highly reliable geometry healing and optimization so the user doesn’t have to. In addition to strong technical partnerships with CAD vendors, Elysium’s rich knowledge regarding CAD data gained through 3D data translation and data processing is what makes this possible.

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**CADdoctor’s Data Leverage**

CADdoctor supports not only manufacturing phases from design, analysis, prototyping, to fabrication, but also provides complete support for 3D data utilization in various areas such as medical, computer graphics, and plant engineering.
3D data translation and PDQ validation intercede the product lifecycle and are fundamental to maximizing 3D data.

### CAD Data Validation and Healing

3D data translation is not just simply about translation between data formats. It is also necessary to validate errors such as tiny elements, tiny segments, and large gaps which may affect the results of translation. If there are any errors that must be fixed to achieve quality data integrity, CADdoctor will accomplish this by utilizing Elysium’s unique product data validation criteria and superior healing functionality.

#### Detection and Visual Representation of Errors

CADdoctor is based on longstanding experience in data translation which has resulted in well-tuned validation criteria. By selecting which CAD system to convert to, the validation criteria is automatically adjusted for the target CAD system. Validation based upon the PDQ guideline outlined by SASIG/JAMA/JAPIA is fully supported. The quantity of errors detected will be listed in the Work Panel and categorized by each validation category and are each assigned a priority. By selecting a validation category, the error will be instantly highlighted in the model making it very easy to locate. Click another button, and you’re zoomed right up to the current error and ready to address it with a recommended healing operation presented by CADdoctor.

#### Automatic Healing

Geometry related errors are found via PDQ validation in most cases. By clicking the Auto-Heal icon in CADdoctor, Elysium’s automatic healing will begin and geometry will be repaired. Automatic healing in CADdoctor heals through sophisticated techniques such as fine tuning the location and shape of an edge or face. Rest assured, CADdoctor’s automatic healing will not exceed the tolerance established by the original CAD system, ensuring consistency with the original source data. Parameters for automatic healing can be easily optimized, and saved as default, contributing to the best practices of your business.

#### Interactive Healing

Interactive healing enables visual confirmation and optimal healing of significant errors which cannot be automatically fixed. Recommended healing operations are displayed when errors are selected from the Work Panel to assist with your healing efforts. CADdoctor’s interactive healing is very intuitive, even for a first-time user. The new Guide feature of CADdoctor will direct users through the healing process, leaving guesswork out of the equation. The Navigation functionality of CADdoctor will explain each step of the healing process by supplying the user with sample images throughout the process.

### Feature Detection and Removal

For development of FEM models and mold design, the Geometry Simplification Option supports the development of light weight models by automatically detecting and deleting detailed geometry irrespective of the feature tree.

#### Feature Detection

Feature Detection identifies features such as fillets, holes, boss and rib, and steps from the geometry of the 3D data. Since characteristics are captured strictly from the geometry without relying on the feature tree, detection of features from any CAD data format is possible. The detected features are color coded and the number of detected features are listed. Just as with PDQ Validation, each feature can be highlighted and zoomed up to, allowing an inspection for omissions or superfluous detection. In such cases, target elements can be easily added or removed by clicking on the elements.

#### Feature Removal

All detected features can be removed with one swift operation. Selective removal is also possible should the user decide to skip some of the detected features. Once a feature has been removed, adjacent faces are extended to repair the section of the model which has been eliminated. Sometimes the process of feature removal will lead to abnormal results, such as intersecting faces. In such cases, the original features may be restored to preserve the integrity of the model.

### Geometry Simplification

The Geometry Simplification Option supports development of FEM models, removes fillets prior to mold design, trims for DMU, and maximizes the use of 3D data for a wide range of applications.

#### Removing Features and Unnecessary Parts

When extracting the exterior shape of the model, the detail required to be preserved may be different in different areas of the model. CADdoctor allows control over the kind of envelope to extract. Whether you’d like to extract an envelope with detailed features preserved, or a more simplified version with most features removed, the choice is up to you. In addition to feature removal, CADdoctor’s Envelope Solid provides you with the ability to remove interior parts from the assembly very quickly during the enveloping process.

#### Extracting the Envelope

During envelope creation, all parts are bound together to form a single solid envelope. When binding parts together, internal and external parts are determined, only necessary parts are preserved and all internal geometry is removed. The parts are not bound together strictly by boolean operation - the gaps are also filled automatically, ensuring that hard to find gaps are filled as well. An upper limit distance gap can be set to ensure that the exterior profile of the model is not disturbed.

#### Extracting the Envelope

The Envelop Solid feature extracts the exterior faces of an assembly model in order to create a single solid representation. The interior parts and detailed geometry are removed, resulting in an extremely light weight model.
Polygon Extension / Reverse Engineering

The Polygon option provides functions to create, validate, repair, and edit various polygon data from sources such as 3D measurement machines. It supports the import and export of STL and other polygon data formats as well.

- **Importing Point Cloud Data and Polygon Creation**
  Using the Polygon option, point cloud data from a 3D scanner can be imported into CADdoctor and polygon data can be automatically generated. Higher quality polygon data can be obtained by de-noising, smoothing, and removing outliers from the point cloud data.

- **Importing and Validating Polygon Data**
  In addition to polygon creation from point cloud, you can directly import polygon data from STL, VRML, and OBJ formats. Respectively, polygon data can also be generated from CAD data as a function of this module. Inadequate geometry in the polygon data, such as incompleteness, gaps and overlapping can be the source of flaws in the data. These issues can be detected in advance using the Polygon Validation function. Validation results are listed in the Work Panel. Consistent with the other modules of CADdoctor, you can utilize the Work Panel to quickly locate, zoom up to and highlight the troubled geometry for any detected error.

- **Repairing Polygon**
  Errors detected by polygon validation can be easily repaired using the Automatic Healing functionality built into CADdoctor. For example, if a large hole is detected, CADdoctor fills in the missing polygons ensuring completeness of the polygon mesh.

- **Optimizing Polygon Data**
  The Remesh feature trims uneven polygon without changing the geometry, and even the granularity of the polygon mesh can be adjusted. The Polygon option offers several ways to edit and optimize polygon data. The Smoothing feature is available to smooth polygon containing areas with convex or concave profiles. Polygon Simplification will reduce the complexity of the polygons while preserving the same physical shape. The Wrapping feature extracts the exterior form and creates a closed polygon representation.

Reverse Engineering

In collaboration with the Polygon option, the Reverse Engineering module can generate CAD data from point cloud data obtained from a 3D measurement machine. This option also makes it possible to create CAD data from optimized mesh data obtained via FEM analysis.

- **Automated Surface Segmentation**
  Before creating CAD data from polygon data, polygon groupings or “segments” are proposed. For the segmentation process, the geometry of the polygon data is captured. Areas are automatically detected, and the area of each segment is automatically determined to approximate the surfaces which will be composed in the CAD model. Planar, cylindrical, and conic surfaces are recognized automatically allowing for segmentation based on surface type.

- **Healing Segments**
  Segmentation is automatic, but there are cases where the segmentation may not be adequate due to unevenness from noise, a low density of polygons, or because data is lacking. Areas can be edited to correct segmentation by using such editing commands as connect, divide or extend. Surface type can be easily switched when repairing the area. Also, if the original CAD data is available, source CAD edges can be copied over to the polygon workspace and used as parting lines for segmentation.

- **Automatic Surfacing and Creation of CAD Data**
  Once segmentation is complete, surface creation will be conducted on each segment and complete boundary representation [BREP] CAD data is automatically created. Using CADdoctor, surfacing can be performed on trimmed surfaces with complex edge boundaries, allowing for the creation of a simplified, more effective CAD data representation.

Geometry Verification / Quality Check for Mold Manufacturing

Geometry Verification detects differences in geometry and assembly structure between two different but similar CAD parts or assemblies. Differences are easily identified using CADdoctor’s comprehensive visual interface.

- **Geometry Verification**
  By comparing two similar CAD parts, the differences in geometry and the location of faces and edges can be quickly identified. Detailed verification mode will also detect changes in topology, such as the merging or dividing of faces or edges, or change in tangency between two faces. The verification results are displayed using a color contour map, making it easy to visually identify the differences. Consistent with CADdoctor’s quality verification, you can quickly zoom up to each difference using built-in navigation functionality.

- **Assembly Structure Verification**
  In addition to geometry differences, the Geometry Verification module in CADdoctor can detect differences between two assembly structures: the addition / deletion of parts, assembled part position / rotation, part location in the assembly tree, and part name. Detected differences are highlighted in the assembly tree, as shown in the “Structure Comparison” panel [left]. Each difference can be examined by the “zoom up to” functionality of CADdoctor. Massive assembly models are not exempt from structure verification, due to our unique way of displaying the differences – showing only changed parts and hiding others in the “Structure Comparison” panel. CADdoctor finds corresponding parts in the two assemblies by referring to various information such as internal ID, component alignment and number of elements. This enables CADdoctor to provide the most accurate verification.

- **Check Results Report Generation**
  The results from geometry verification can be exported in an XML format which is viewable by most web browsers. Using this report, results can be shared with other departments or partners who do not have CADdoctor. The report includes images of parts which do not have corresponding parts in the compared assembly and images of modified faces, making it easy to check where the design has changed. This report is also useful for checking product data quality, you can easily examine whether there are unexpected differences of parts or faces.

Quality Check for Mold Manufacturing

The Quality Check for Mold Manufacturing option does not require much expertise in plastic injection molding in order to check plastic mold formability and construction using CAD data.

- **Manufacturing Check**
  The Mold Manufacturing check is run on 11 items in 3 categories. The first category, Product Formability, is used to check for product quality issues during or after form, such as inadequate or excessive thickness. The second category is for Mold Construction, which contains checks for undercut or slide candidates, which often leads to complex mold construction, increasing the mold manufacturing cost. The third category is Mold Formability, for the checking of such issues as sharp edge, deep trench, and small bump. These types of detected characteristics cannot be formed by the mold. By setting tolerances and thresholds based on company standards, you can ensure that every item which does not meet those standards will be detected.

- **Check Results Report Generation**
  The results from the manufacturing check can be exported in an XML format which is viewable by most web browsers. Results can be shared with other departments or partners who do not have CADdoctor in order to facilitate design changes. The report also includes an overall image of the model and exploded images of each issue ensuring that readers of the report can easily understand and interpret the issues.

Polygon Data Creation, Checking and Healing

Polygonize point cloud

Automatic surfacing

Smoothing

Healing Segments

Stitch

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