Data transfer between CAD and DCC Applications

SUPPORTED BY

“Ghost at Sunrise”
Photography by Dmitry «dimson3d» Chekhlov
Location: Russia, Perm Krai, Cherdyn city, Seregovo village
Summer, 2023

Theme

In modern engineering processes we are use 2D drawing and 3D parametric modeling, based on 2D drawings and links between parts.

All geometry based on NURBS and Bézier surfaces with parametric links.

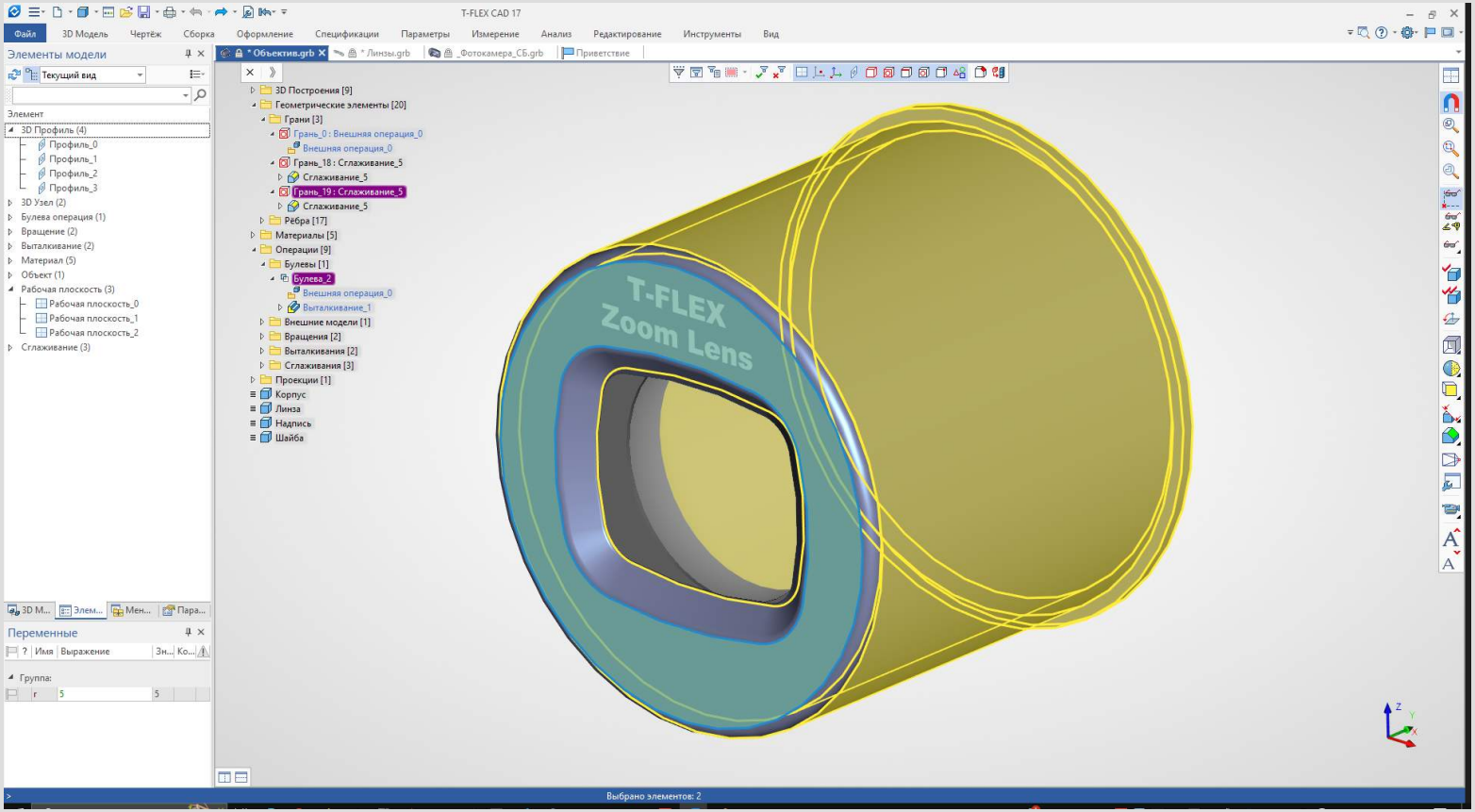
Model parts contain attributes, parameters and over information.

Attributes in one part, can be linked and affect over attributes in over parts.

Key problem in Rendering workflow — correct transfer 3D geometry model data and it's information (instances, lights, materials, textures etc.) between applications.

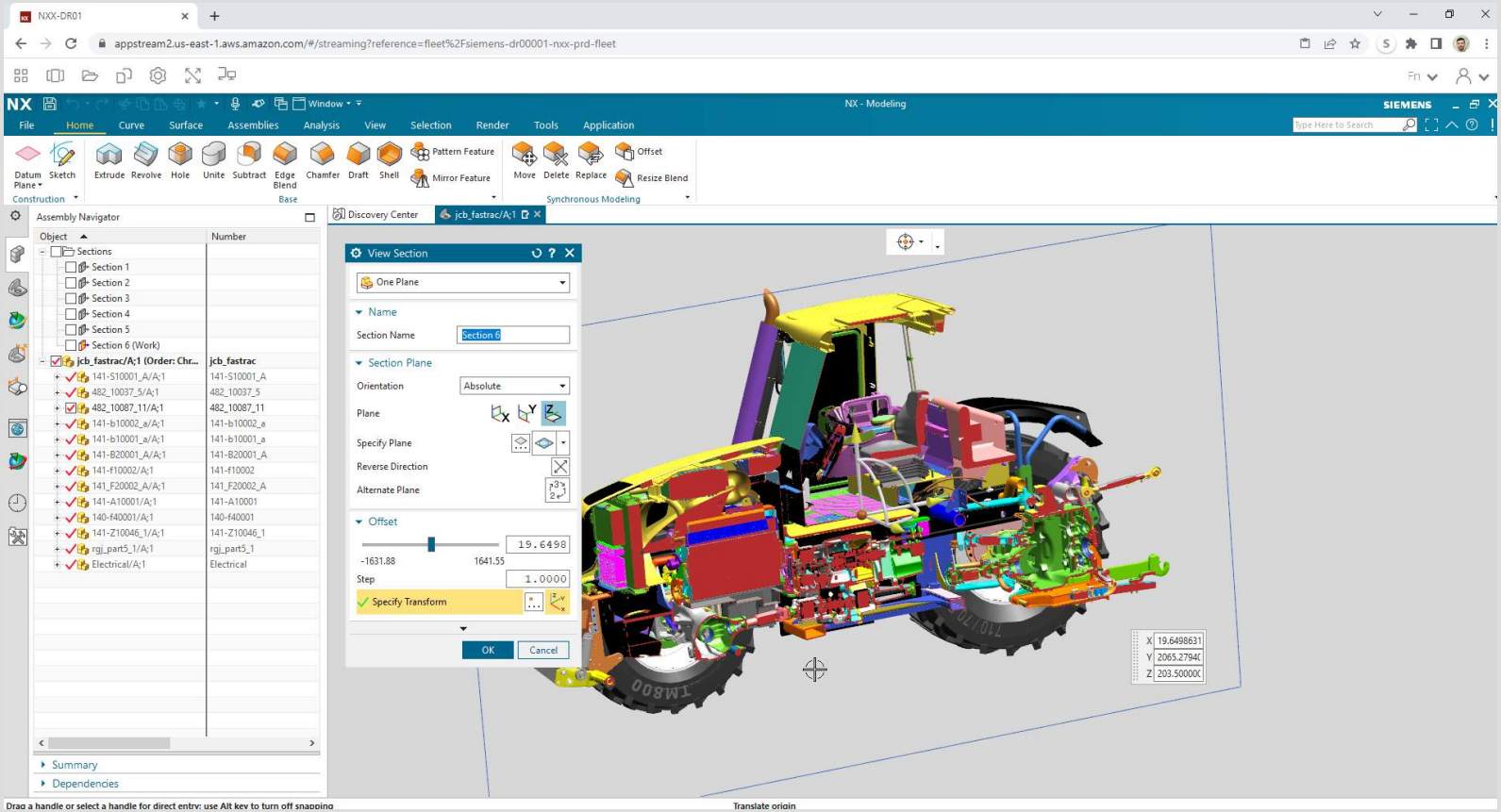
Modern CAD applications

Modern CAD applications



T-FLEX CAD — Modern CAD for modeling, analysis, simulations and rendering products.

Modern CAD applications



Siemens NX (running in web view) — Legendary CAD for mechanical engineering.

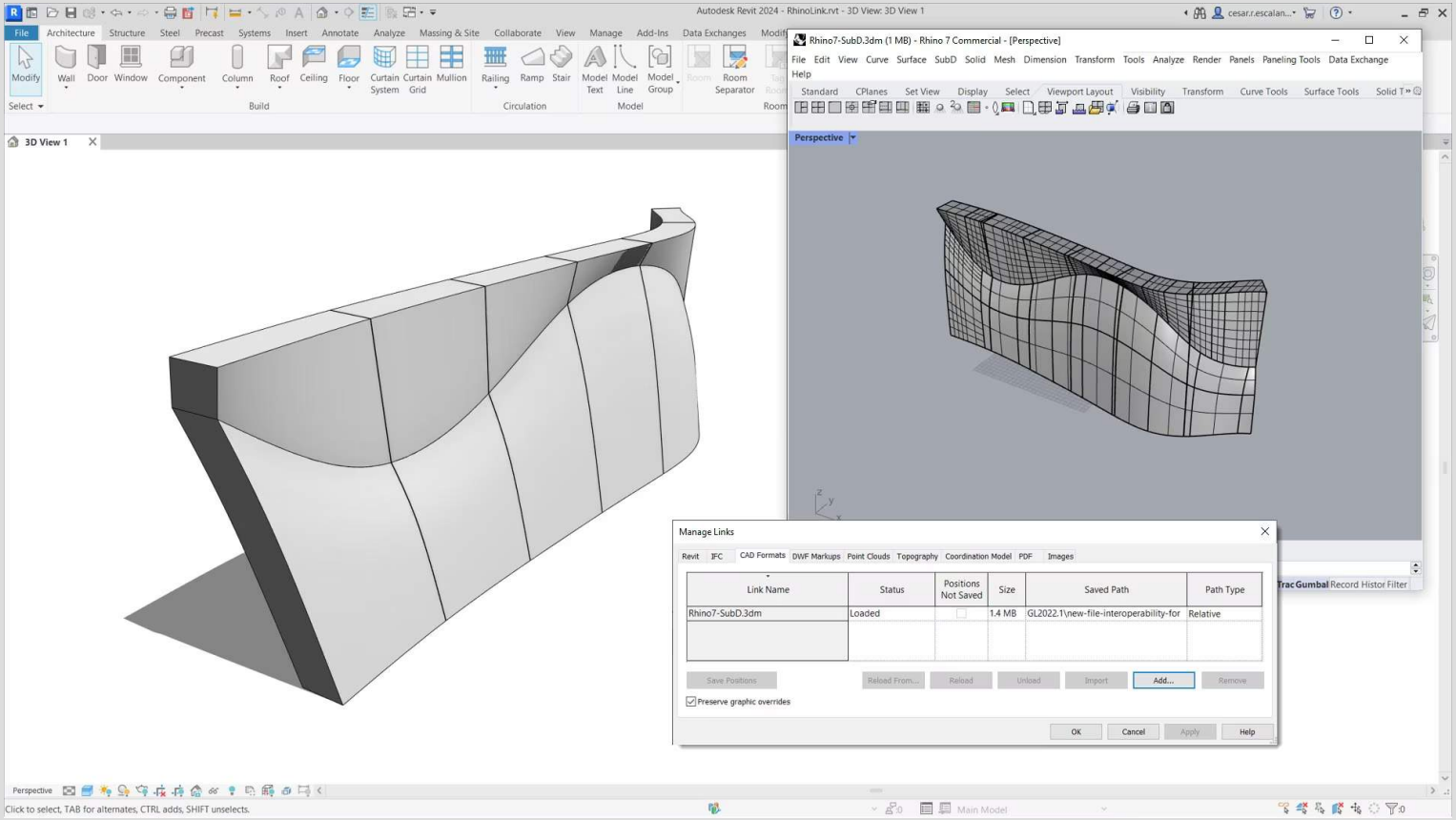
Image courtesy of Siemens

Modern CAD applications

CATIA from Dassault Systèmes SE — CAD for large scale mechanical engineering and industrial design.

Image courtesy of Dassault Systèmes SE

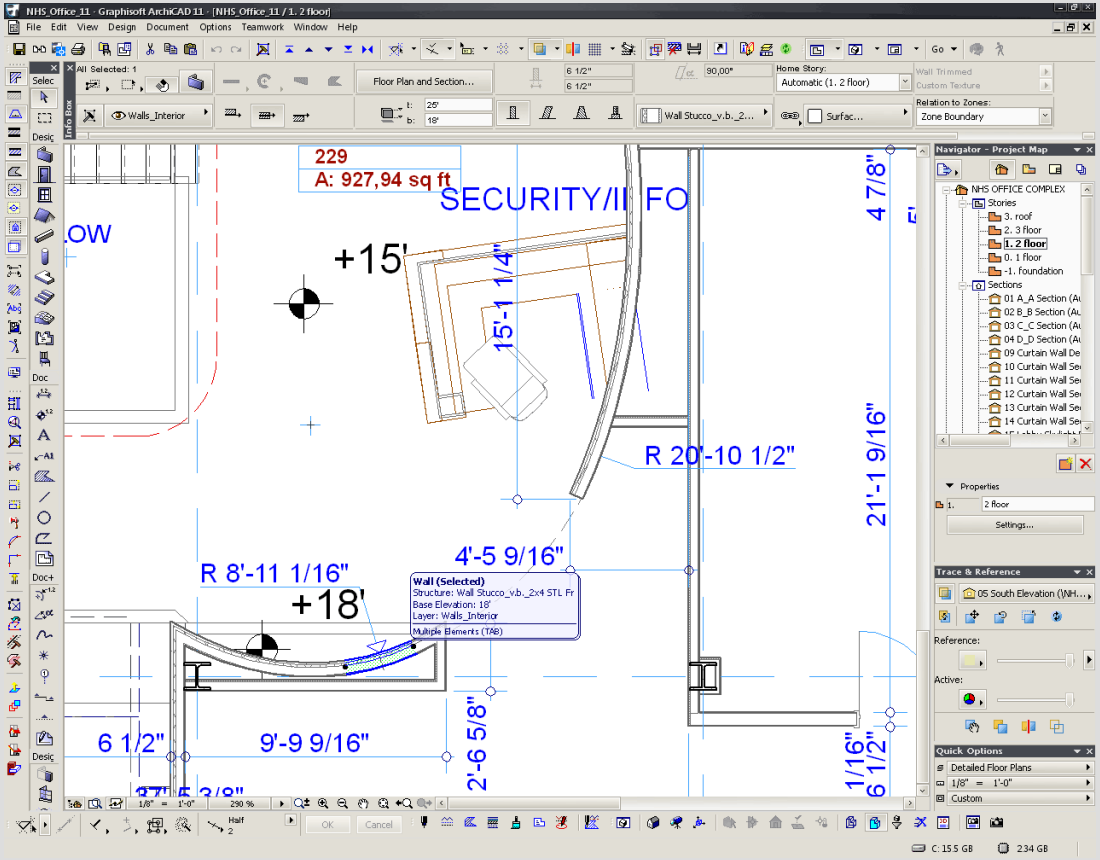
Modern AEC CAD applications



Autodesk Revit – modern 3D architectural modeling and engineering CAD.

Image courtesy of Autodesk Inc.

Modern AEC CAD applications



Archicad – modern AEC CAD with powerful features in modeling, data exchange and planning.

Image from Wikipedia

Progressive technologies in modern modelling

Parametric and procedural modelling

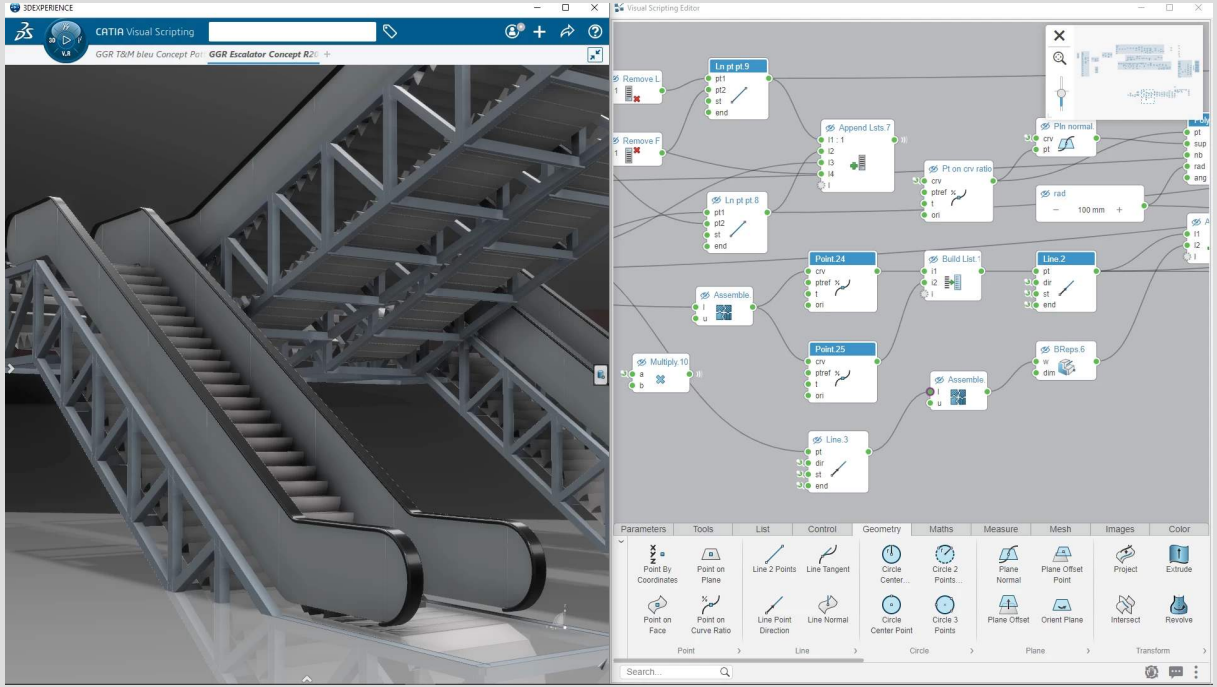


Image courtesy of Dassault Systèmes SE

Progressive technologies in modern modelling

Parametric and procedural modelling

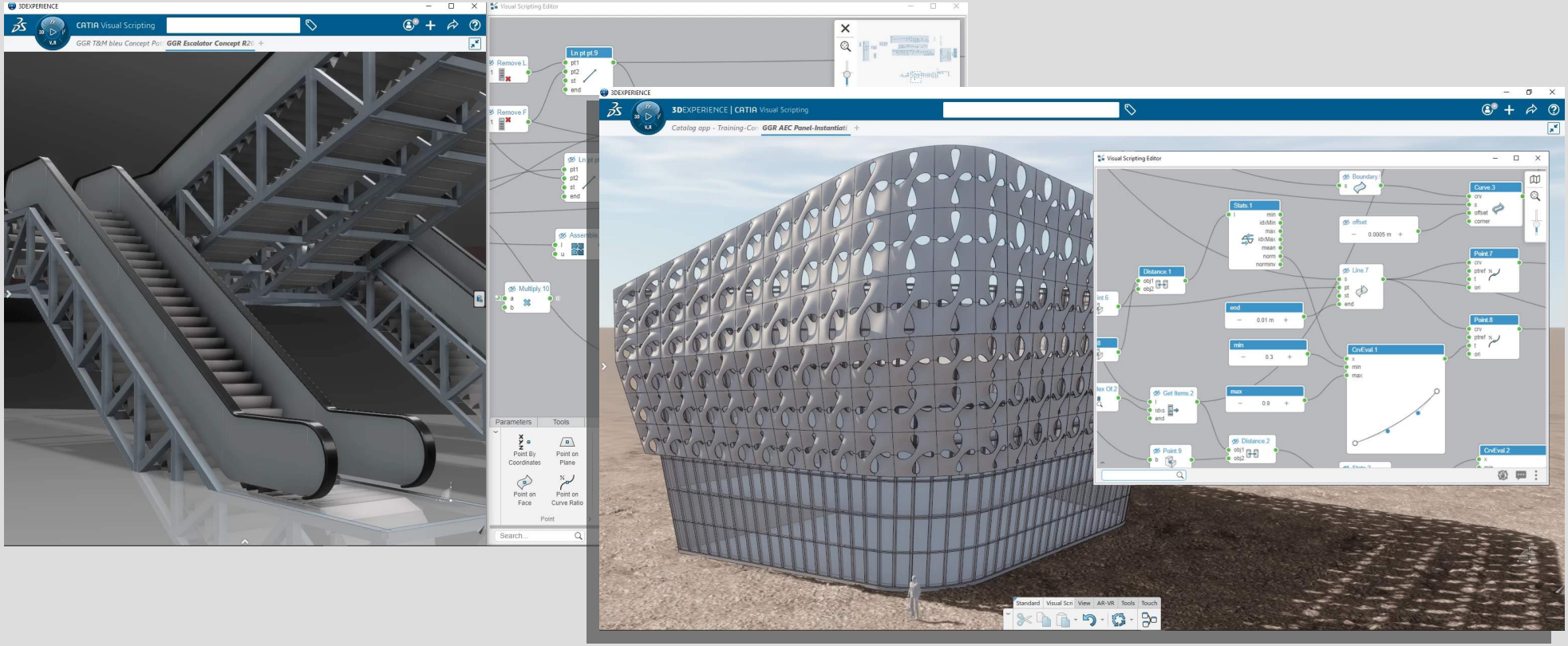
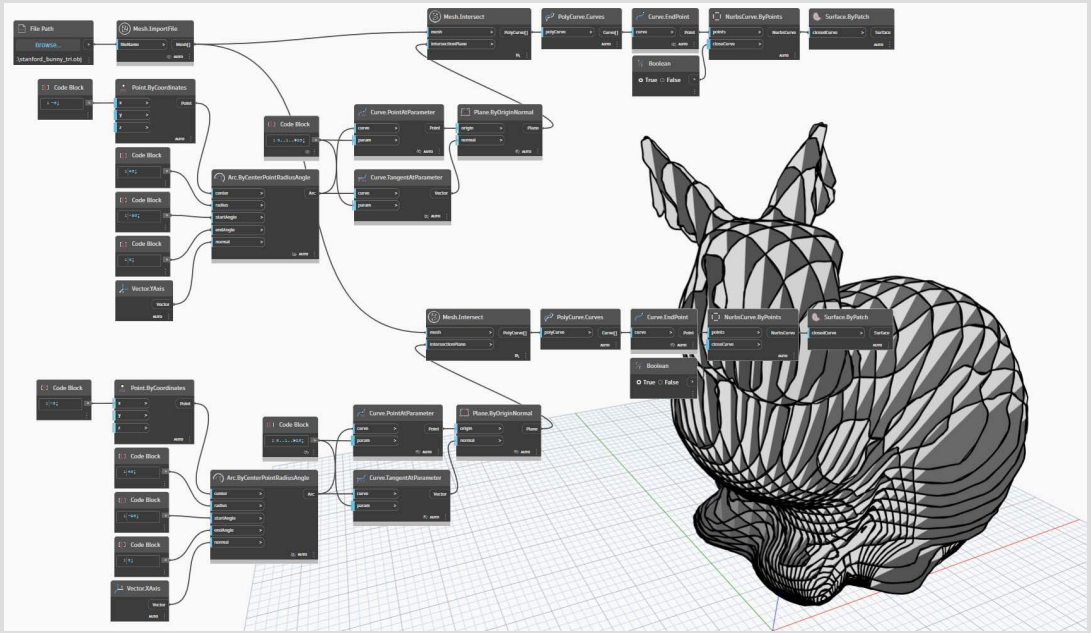


Image courtesy of Dassault Systèmes SE

Progressive technologies in modern modelling

Parametric and procedural modelling benefits



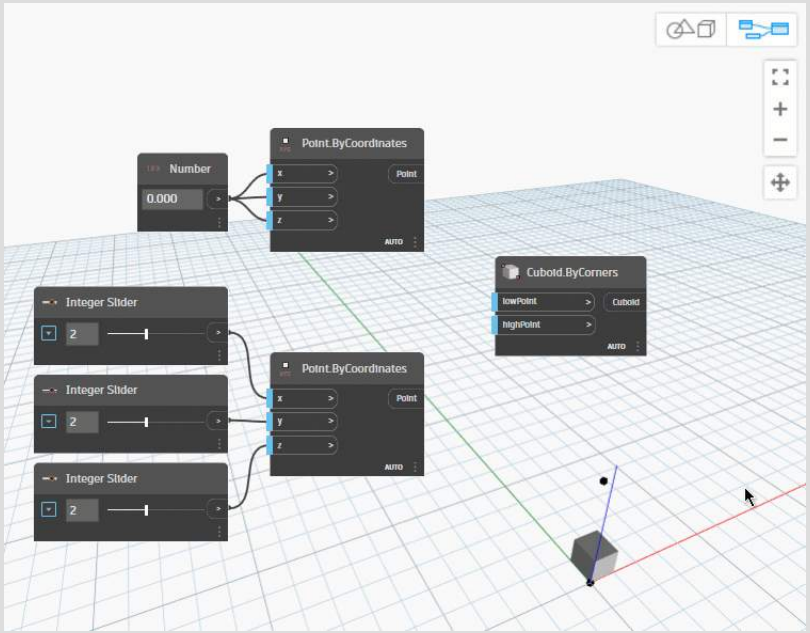


Image courtesy of Autodesk Inc.

Key problems in data transfer

Key problems in data transfer

If you work with one or two CAD applications, transferring data between them can be straightforward. Especially if you are working with products of the same line.

For example, Autodesk Revit.

Data between applications in a single format is easier to save and transmit than between different platforms with different data formats.

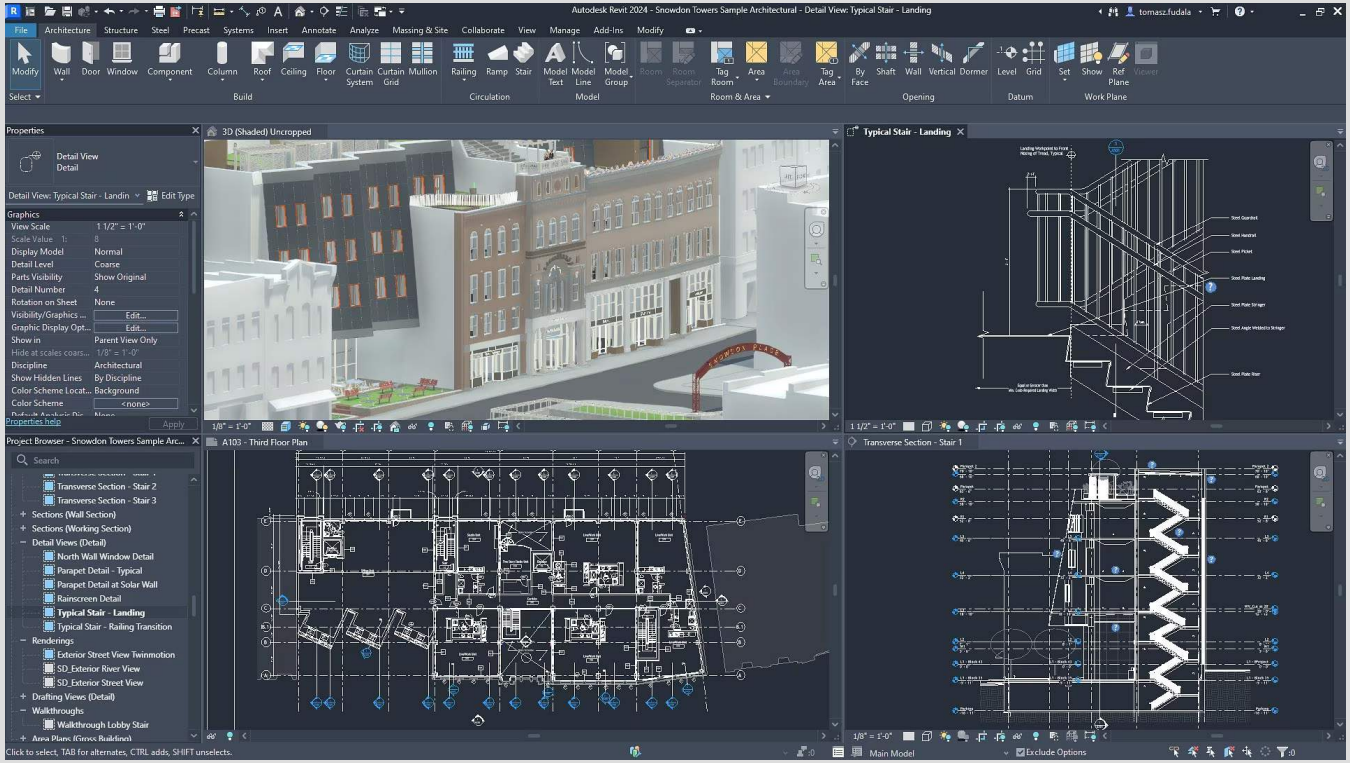


Image courtesy of Autodesk Inc.

Key problems in data transfer

An important condition is to prepare the data in one application and export the data to a format supported by the target application.

For example, Autodesk Revit and Bentley Microstation (.dgn) or Autodesk AutoCAD (*.dwg).*

The model can be exported in its entirety, but this can create many problems.

For example: hi-detaled geometry, non-correct styles, lost additional data, dependencies between elements and many moore.

For correct export, I recommend preparing the model and data in accordance with the requirements of the target format and supported by the target application.

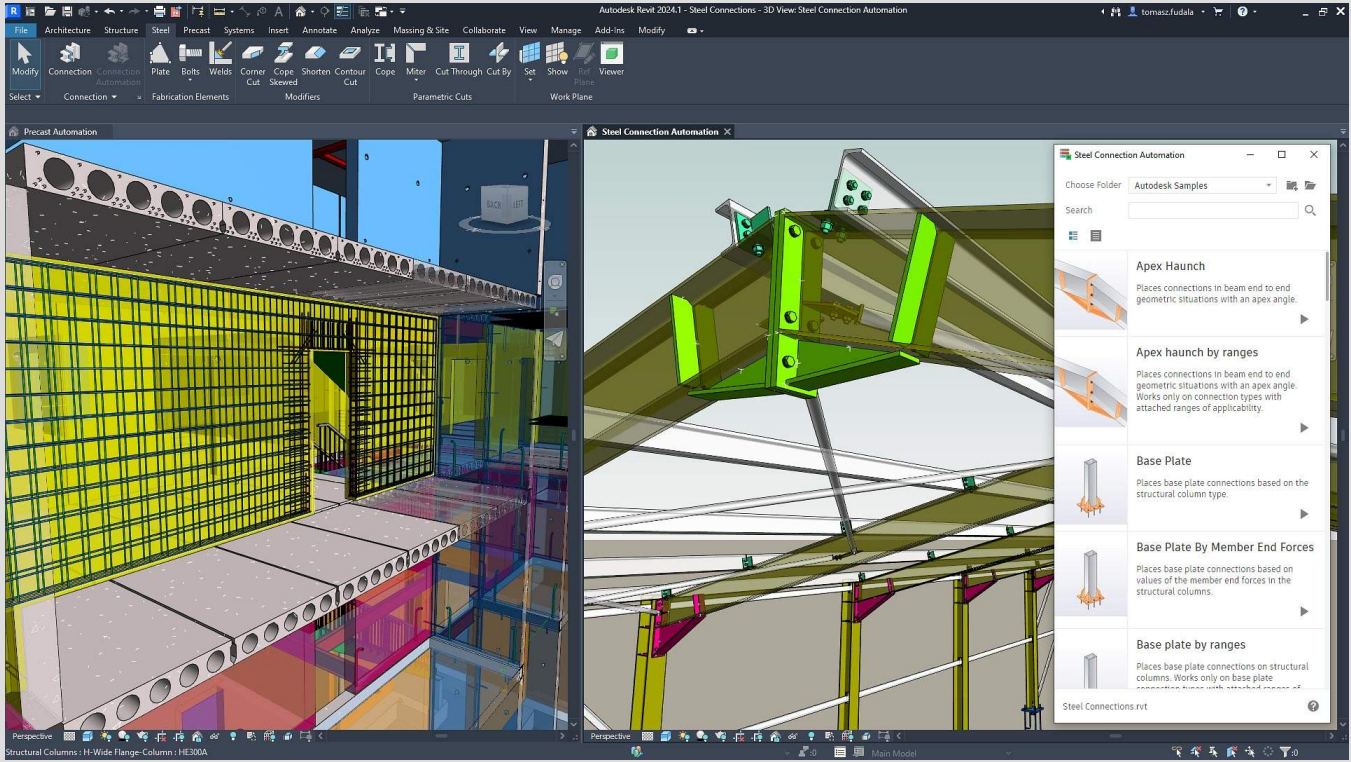
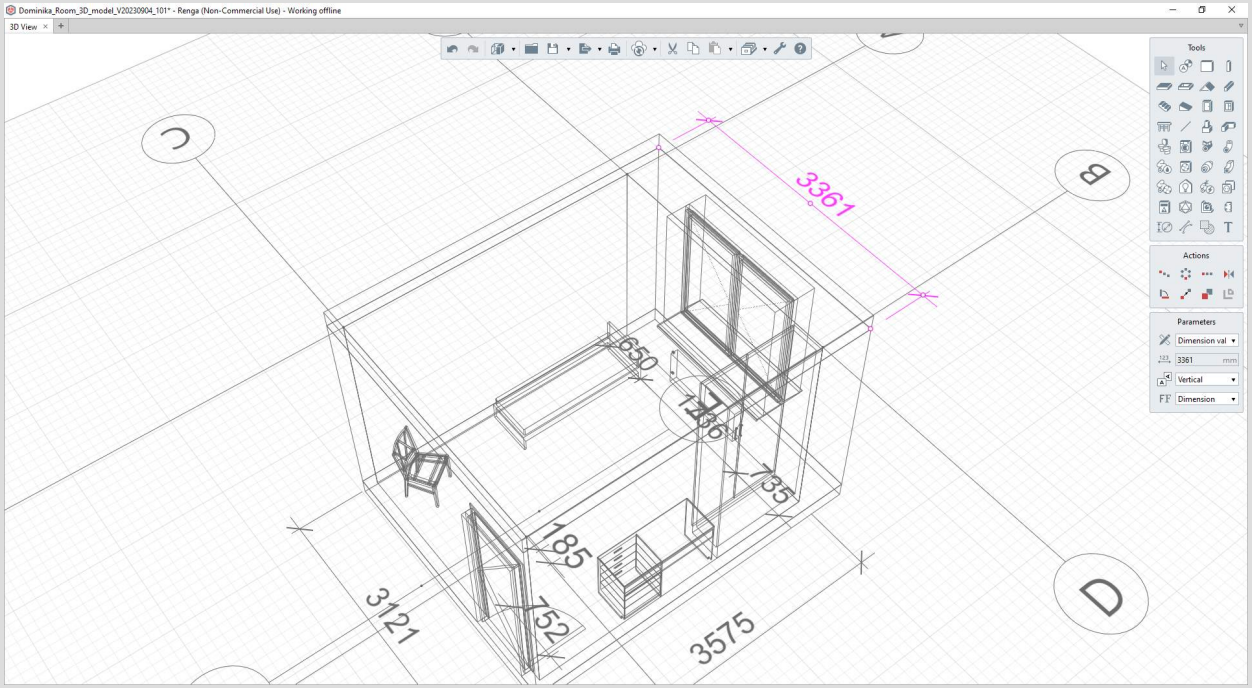


Image courtesy of Autodesk Inc.

Example workflow graph

Example workflow graph | CAD to CAD

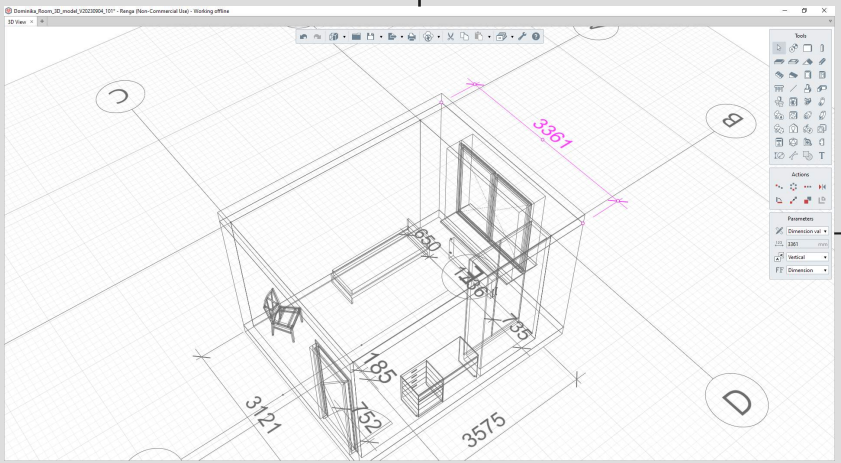


3D Model in AEC CAD

Renga BIM as example

Example workflow graph | CAD to CAD

Solid-surfaces
Geometry
*.sat
*.stp
*.ifc
*.stl
Parasolid
*.jt



3D Model in AEC CAD
Renga BIM as example

Supplemental data
- Materials
- Textures
- Drawings
- Parameterization
- Construction history

Example workflow graph | CAD to CAD

Solid-surfaces
Geometry
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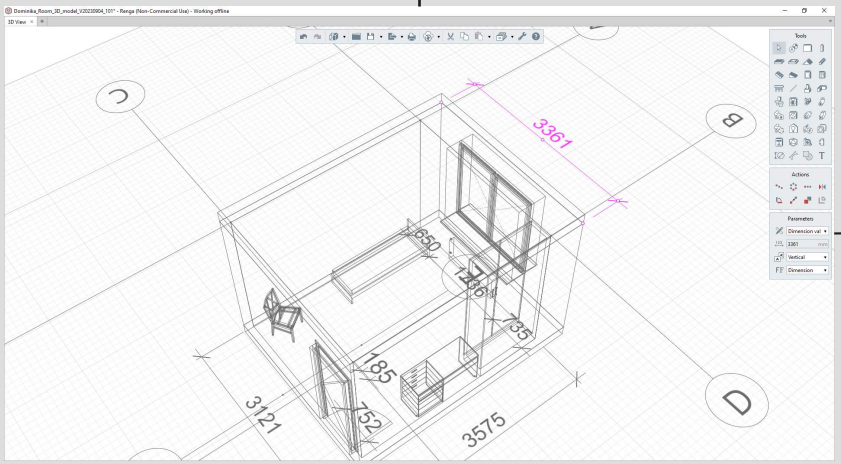

3D Model in AEC CAD

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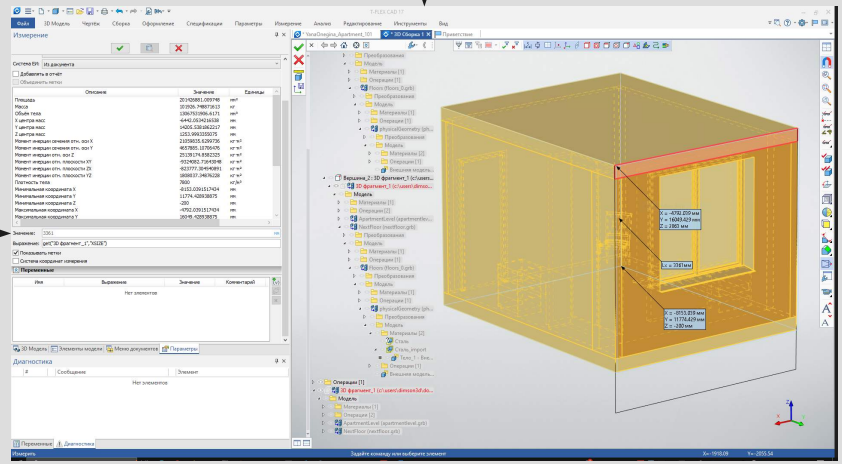
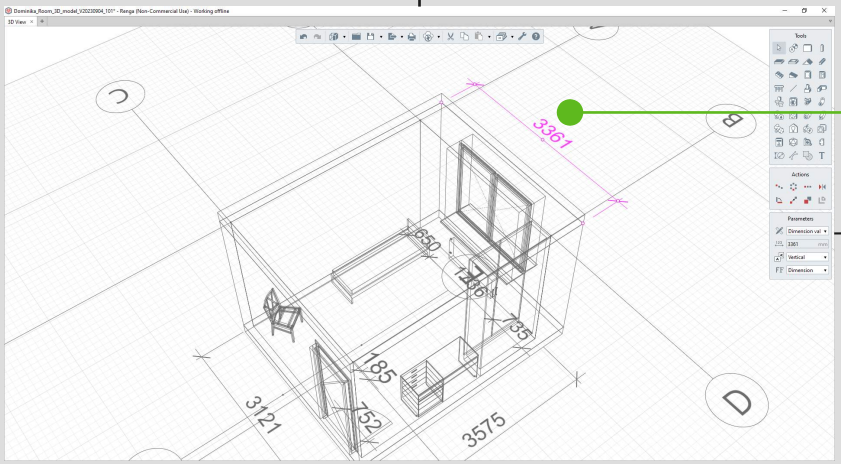


AEC 3D Model in mechanical engineering CAD

T-FLEX CAD 17 as example

Example workflow graph | CAD to CAD

Solid-surfaces Geometry
*.sat
*.stp
*.ifc
*.stl
Parasolid
*.jt



3D Model in AEC CAD
Renga BIM as example

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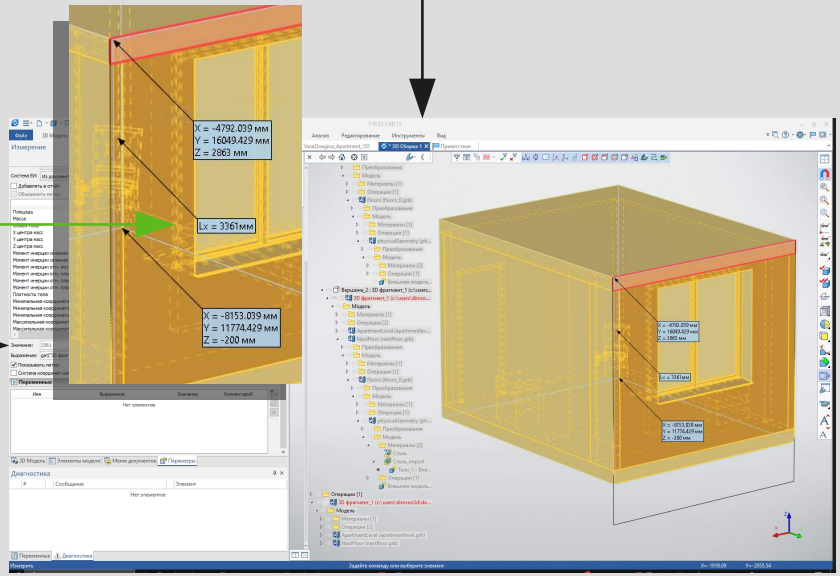
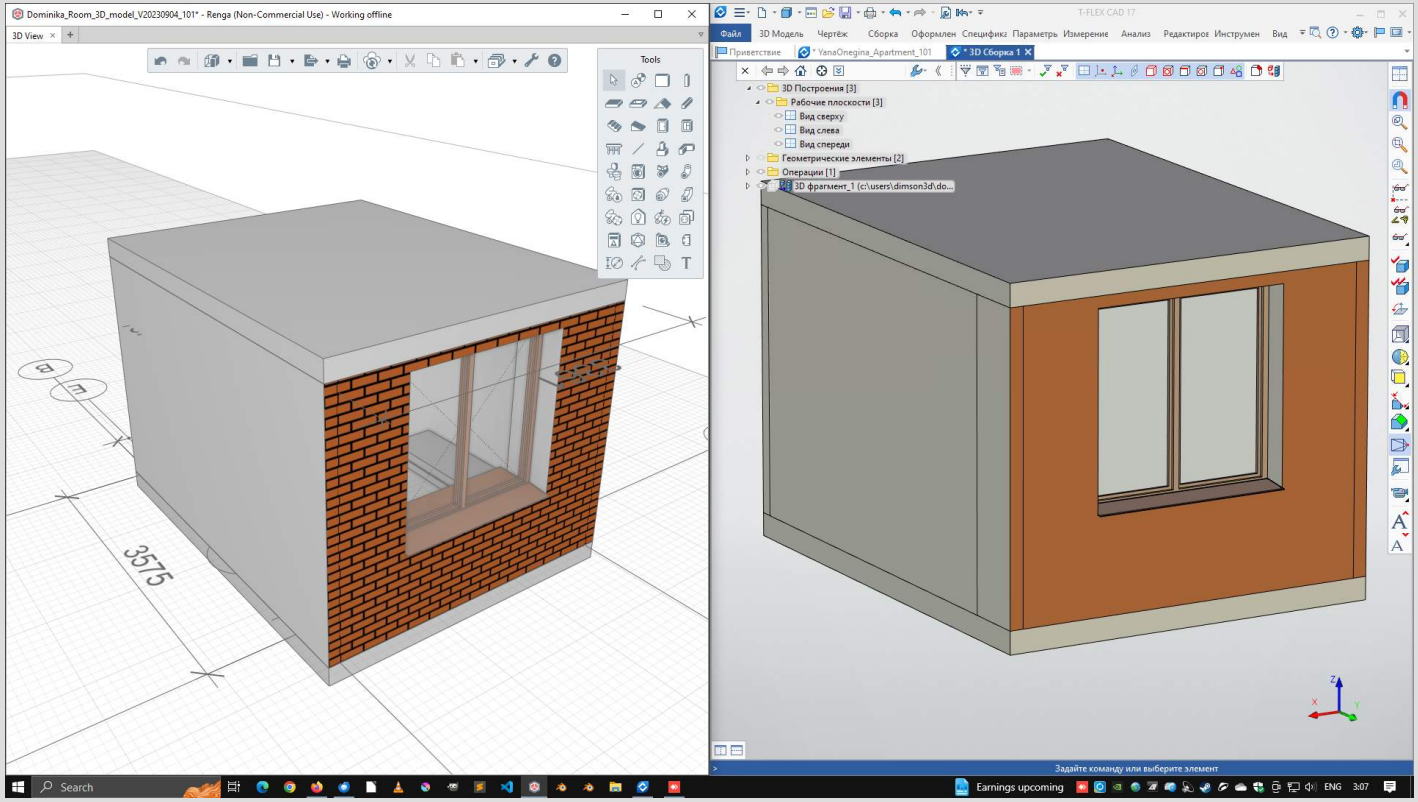


AEC 3D Model in mechanical engineering CAD
T-FLEX CAD 17 as example

Example workflow graph | CAD to CAD



3D Model in AEC CAD
Renga BIM as example

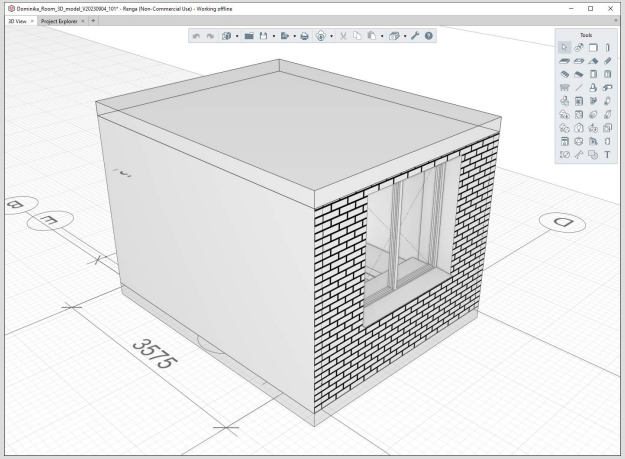
AEC 3D Model in mechanical engineering CAD
T-FLEX CAD 17 as example

Workflow recommendations | CAD to CAD

Here are some recommendations for transferring data between CAD applications:

- To transfer geometry between CAD systems, use solid geometry formats used in the industry.
  - These formats are: *.stp, *.stl (polygonal), ACIS (*.sat), *.iges, Parasolid, Industry Foundation Classes (*.ifc).
- Check model for duplicates.
- Select the optimal level of detail (LOD`s).
  - This is especially important when working with architectural models.
- Try to exclude geometry with high element density.
- If it is possible to export elements as curves, export them!
  - Modern rendering kernels allow you to render curves as polygonal objects.
- Materials can be exported either as part of the model or separately if the CAD system supports exporting materials to a material representation format.
- Other model data can be shared through a single database or collaboration system.
- Before transferring your model to another CAD system, be familiar with the specifics of exporting data to the selected data format.

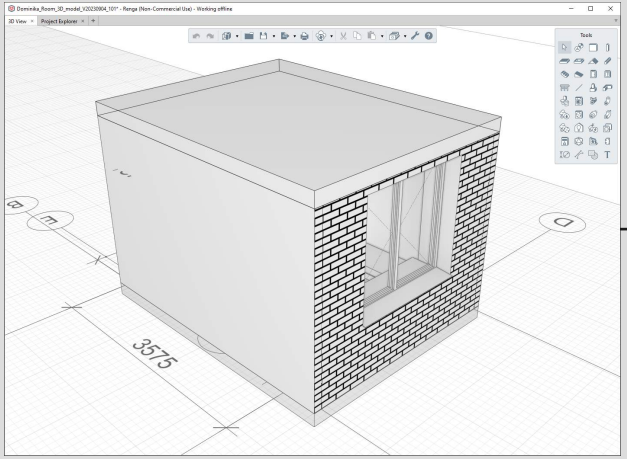
Example workflow graph | CAD to DCC



3D Model with data in CAD

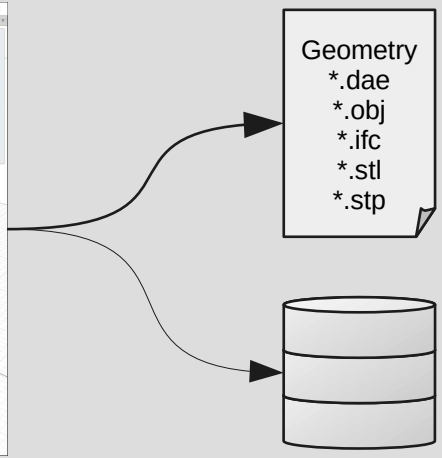
Renga BIM as example

Example workflow graph | CAD to DCC



3D Model with data in CAD

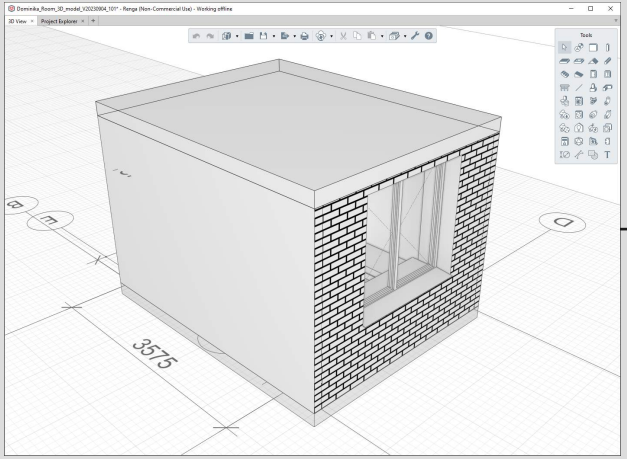
Renga BIM as example



Supplemental data

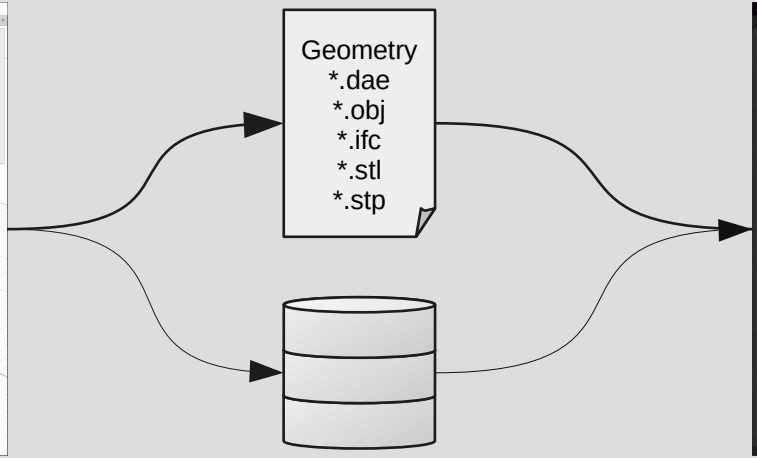
- Materials (*mtl)
- Textures
- Lights (*.ies)
- Links
- Drawings (*dxf)
- Parameterization

Example workflow graph | CAD to DCC



3D Model with data in CAD

Renga BIM as example



Supplemental data

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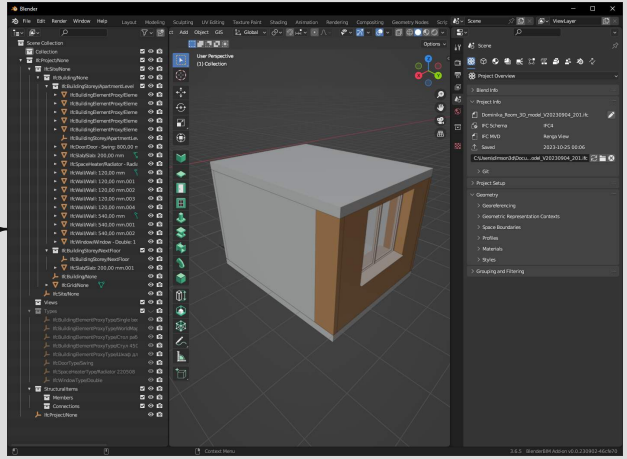
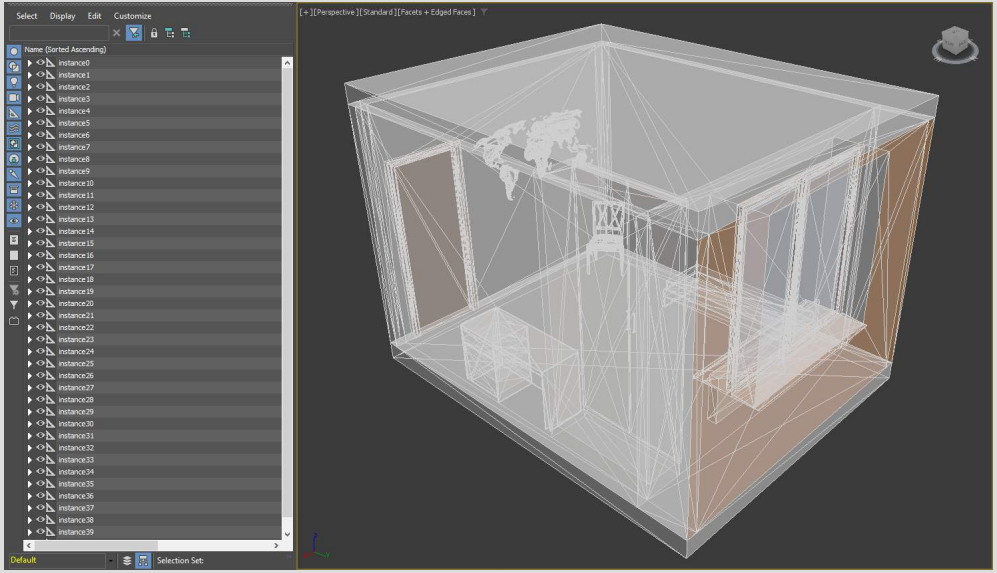


3D Model in Blender with data in IFC format

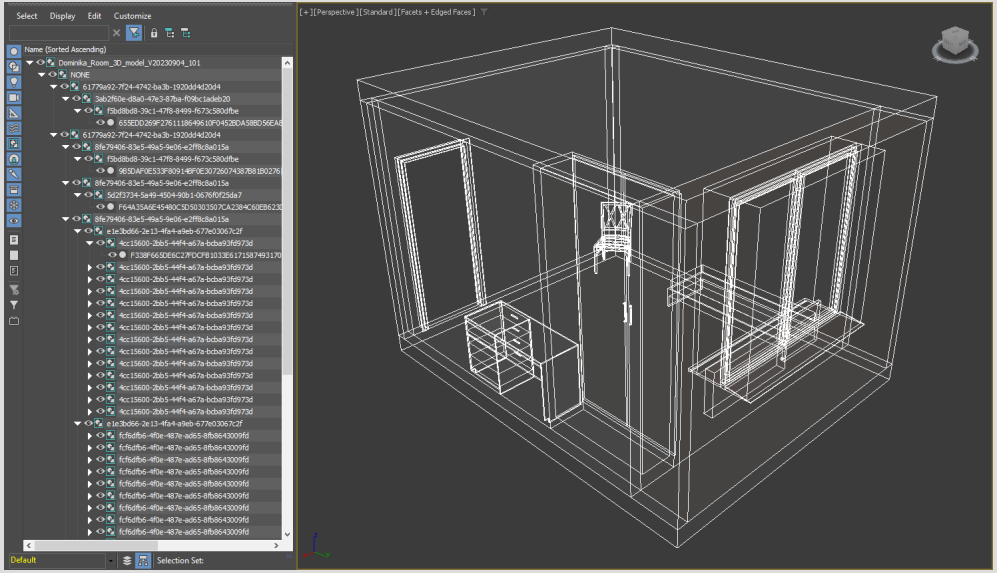
BlenderBIM add-on used for example

Example data transfer result | CAD to DCC



Result import model from Collada *.dae format

Renga BIM to 3ds Max

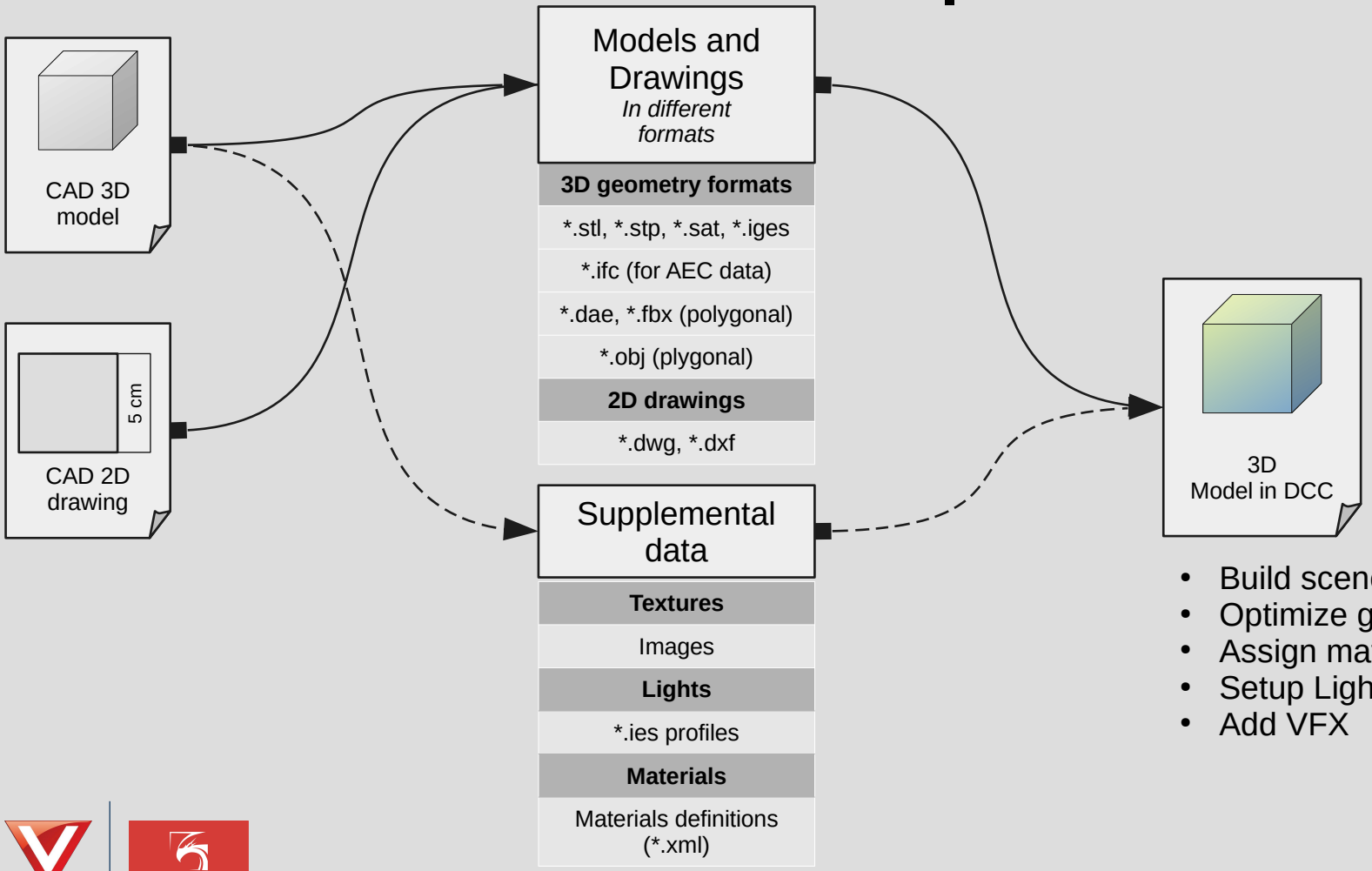


Result import model from ISO 10303-21 *.stp format

Renga BIM to 3ds Max

Workflow recommendations

Workflow recommendations | CAD to DCC



- Build scene
- Optimize geometry
- Assign materials
- Setup Lighting
- Add VFX

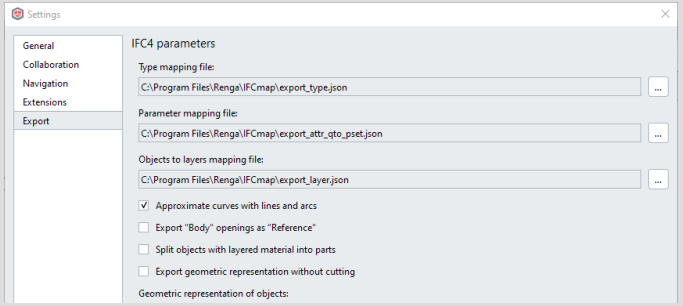
Workflow recommendations | CAD to DCC

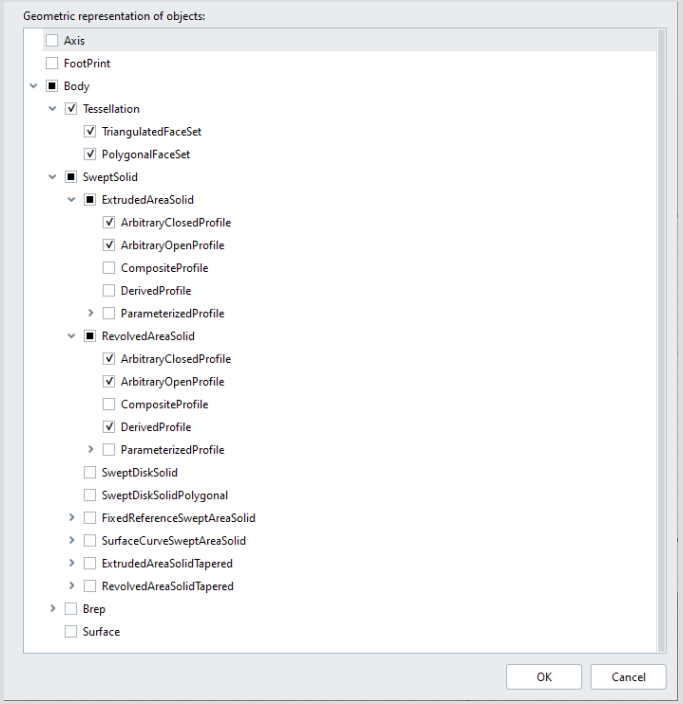
Table below compare few different formats and its result after import in DCC application

Data format	Type of geometry	Import geometry types
*.dwg	• Solids • 2D Curves (lines) • 3D Curves (lines)	• Splines • PolyGeometry (triangulated)
*.stp	• Solids	• SolidGeometry • PolyGeometry (triangulated, after conversion)
*.obj and *.mtl	• Solids • Materials description • Textures	• PolyGeometry (triangulated) • UV coords • Materials description
*.dae, *.fbx	• Solids • Texures • Materials description • Lights • Light profiles	• PolyGeometry (triangulated) • UV coords • Textures • Materials • Lights with IES profiles
*.ifc	• Solids • 3D Curves (lines) • Materials • Textures	• PolyGeometry (triangulated) • Curves • UV coords • Materials • Textures

Workflow recommendations | CAD to DCC

In this section we will look at the Renga configuration for exporting IFC to a Blender with the BlenderBIM add-on.





In the program settings, Export section, you can determine how the model will be exported to the IFC format.

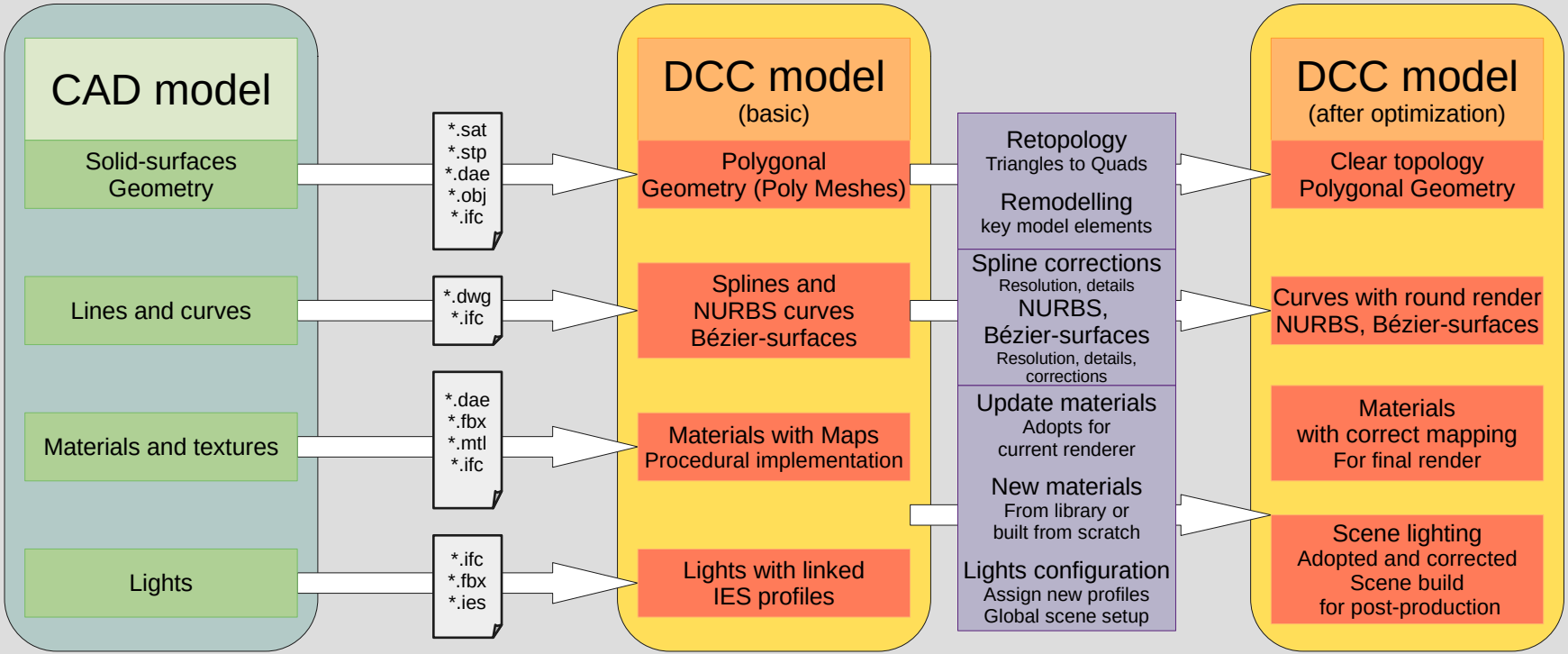
The settings shown on the slide will help you correctly export the model for subsequent import into Blender.

To support the IFC format, use the BlenderBIM add-on.

Pipeline data transfer

Pipeline for data transfer | CAD to DCC

Pipeline in below, demonstrate basic process of transfer data between CAD and DCC applications

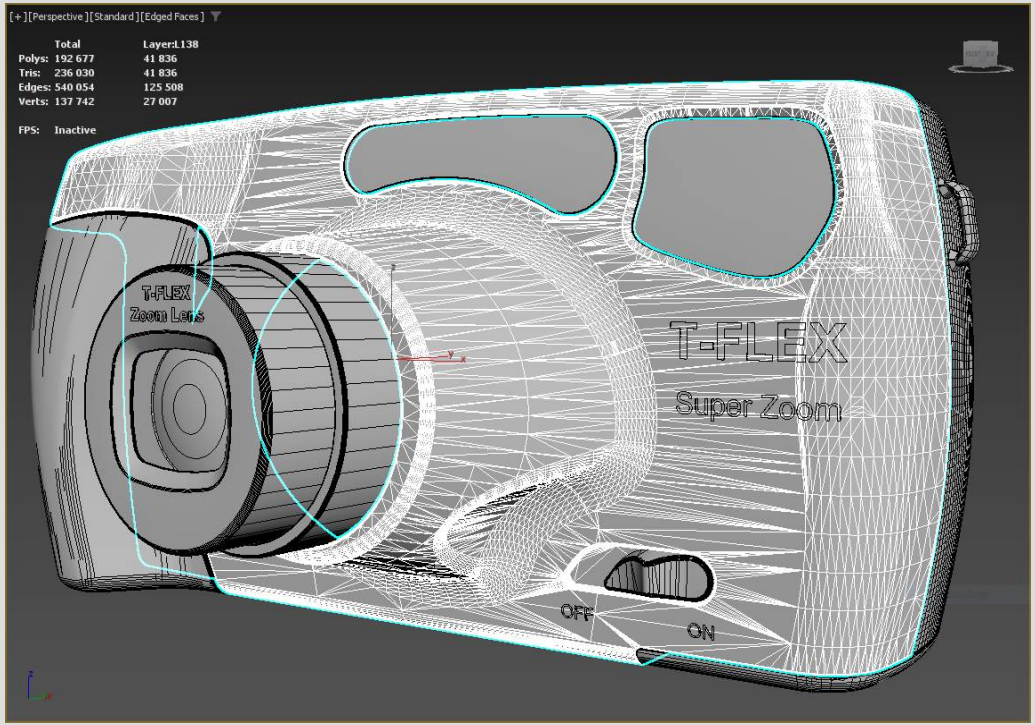


Geometry retopology examples

Modern DCC applications have special tools for rebuilding geometry with more correctly topology.

All triangulated geometry or with different topology geometry can be rebuild with more correct topology.

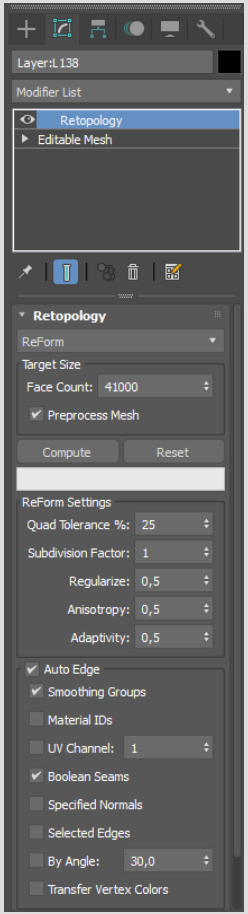
Retopology tools are used to restore the geometry of objects from CAD and digital sculpting.



Model imported from T-FLEX CAD in to Autodesk 3ds Max with Autodesk DXF format.

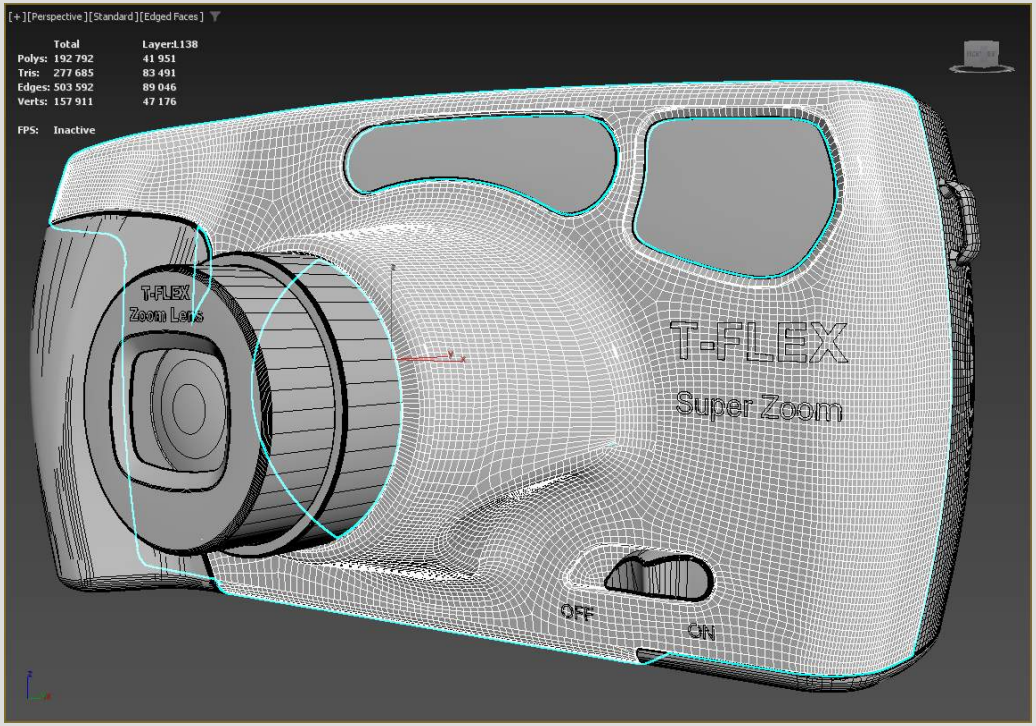
Geometry retopology examples

Use Retopology Tools to automatically optimize the geometry of your high-resolution model to create a clean, quad-based mesh. Useful for removing artifacts and other mesh issues for animation and rigging, these tools can also be used to apply textures and manipulate objects.

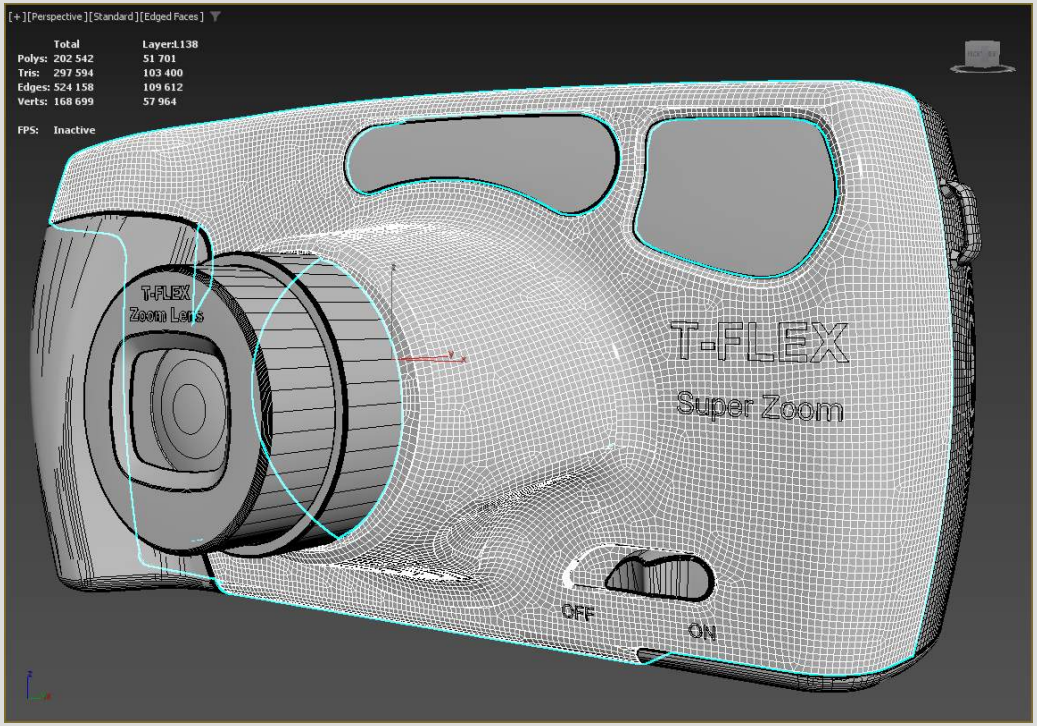


Retopology modifier in Autodesk 3ds Max.

Geometry retopology examples



Result geometry created with Retopology modifier using ReForm retopology algorithm.



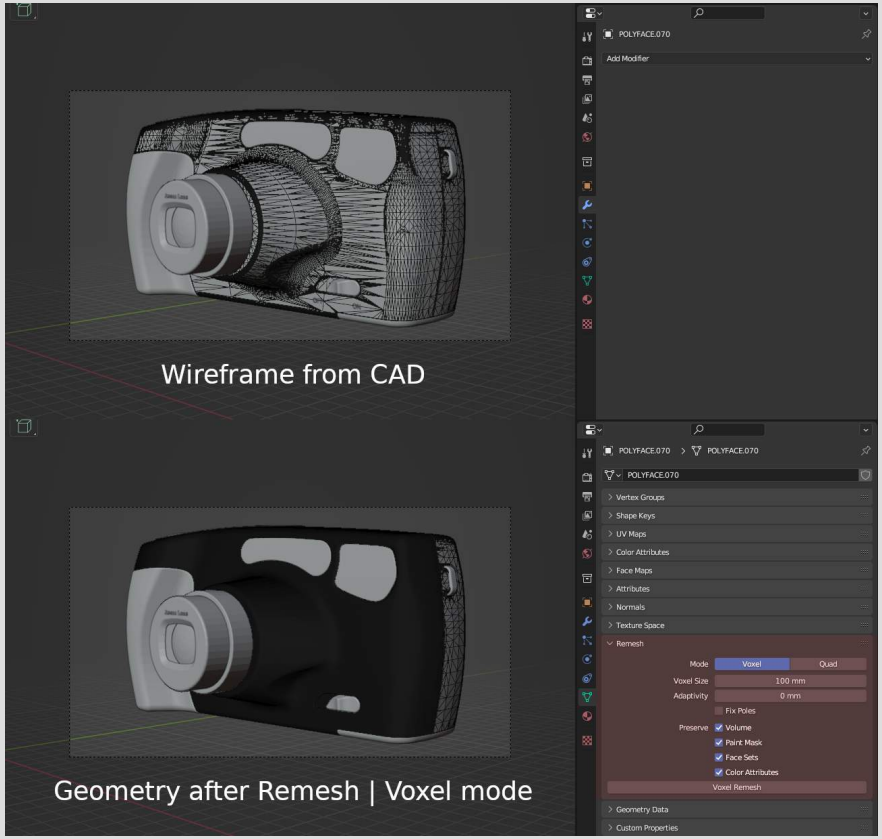
Result geometry created with Retopology modifier using Instant Mesh retopology algorithm.

Geometry retopology examples

Blender provides a set of tools for retopology of geometry with incorrect geometry.

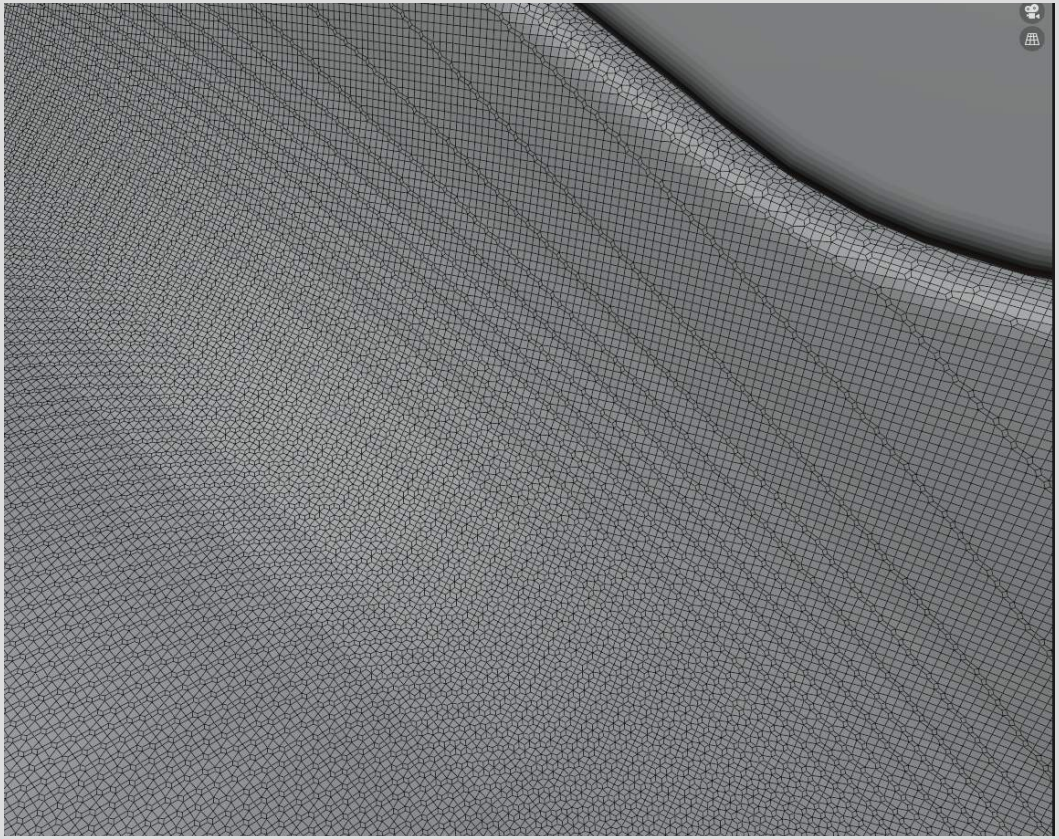
In the Properties panel, Data tab, the geometry topology can be recreated using the Remesh toolkit.

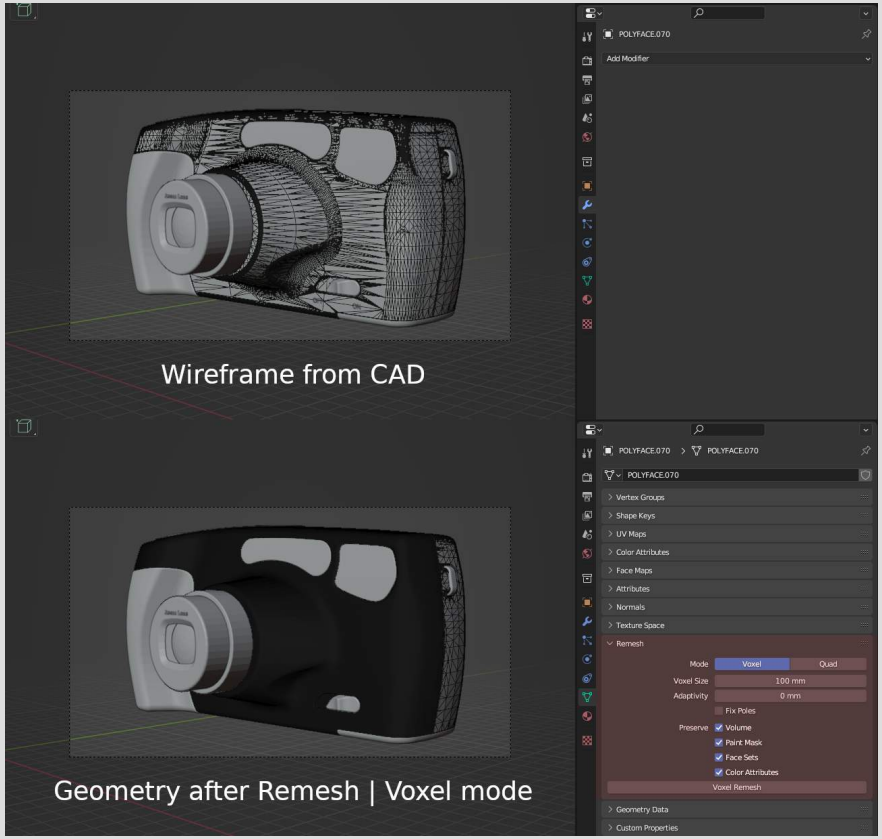
The Remesh supports several algorithms for generating geometry with optimal topology.



Result geometry created with Remesh rollout using Voxel retopology algorithm.

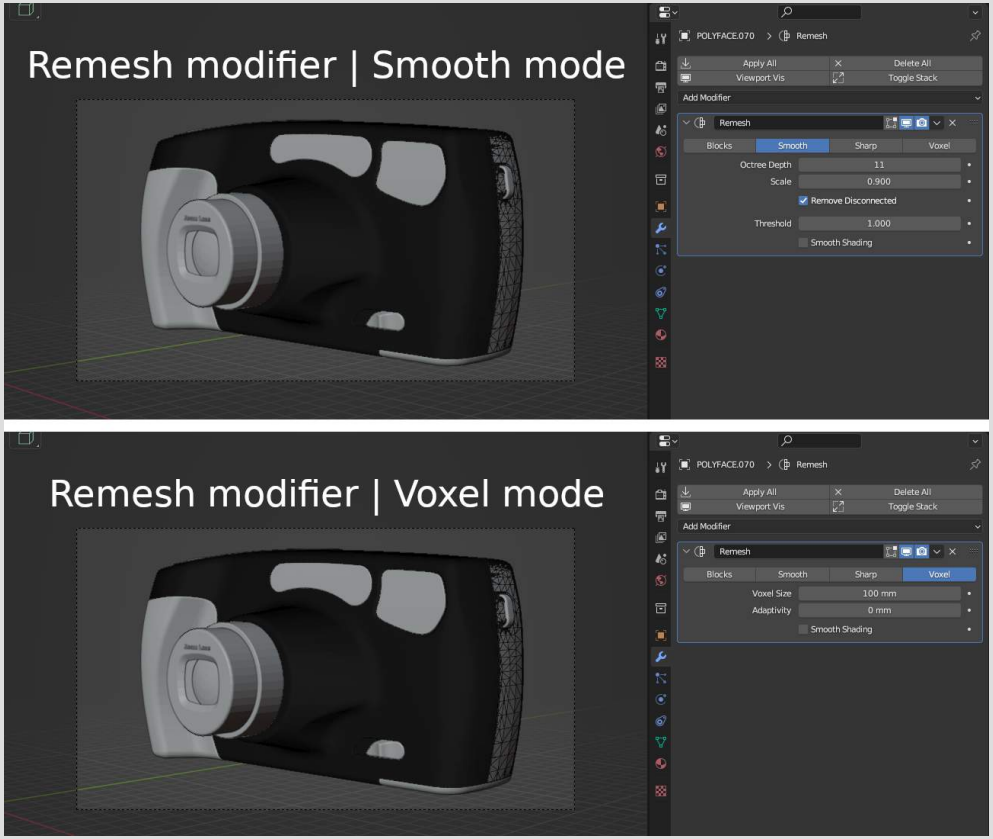
Geometry retopology examples





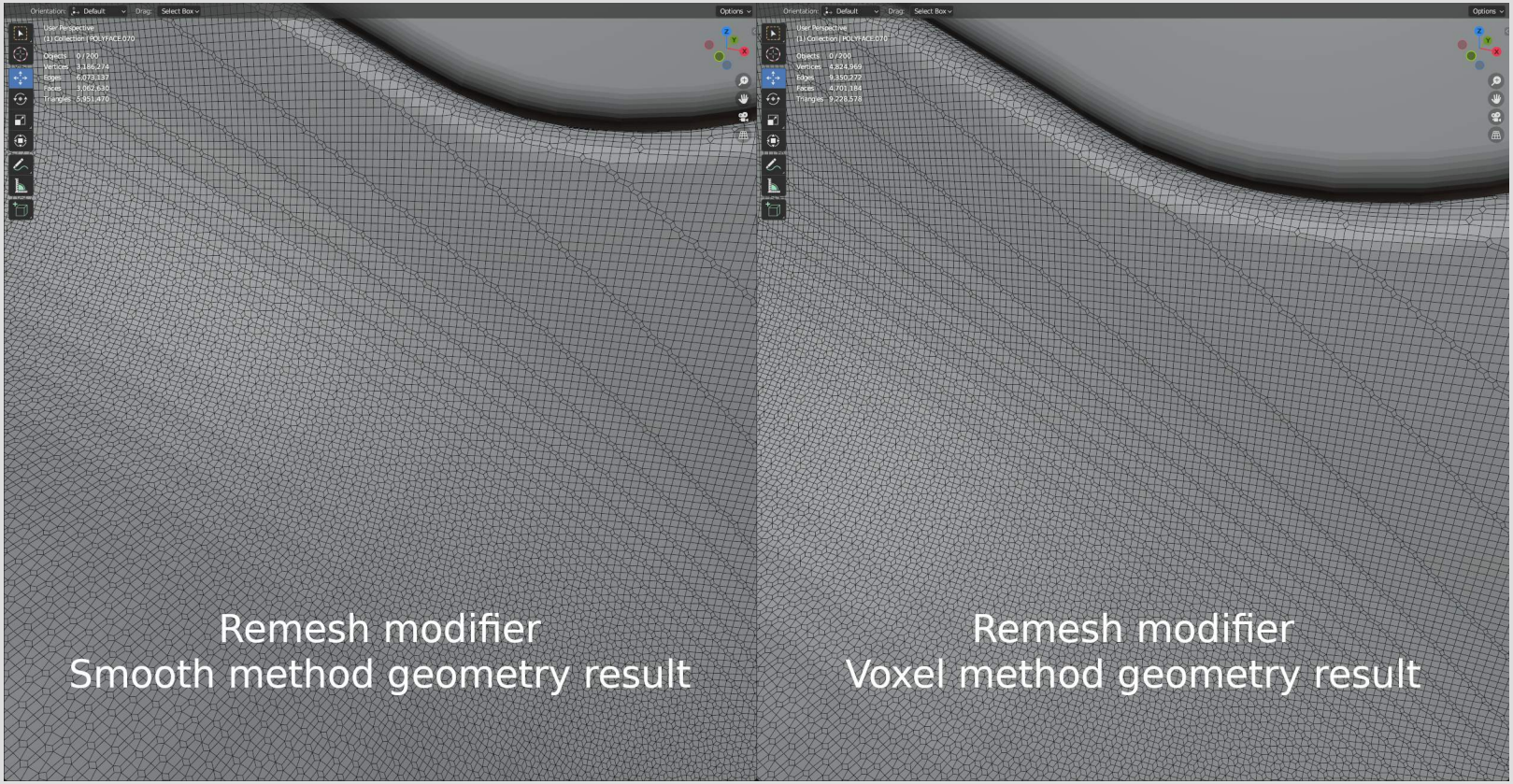
Result geometry created with Remesh rollout using Voxel retopology algorithm.

Geometry retopology examples



Result geometry created with Remesh modifier using Smooth and Voxel retopology algorithm.

Geometry retopology examples



Result geometry created with Remesh modifier using Smooth and Voxel retopology algorithm.

DEMO

IN NEXT VIDEO

In next video we talk about work with Matte ID`s and Cryptomatte passes in Blender Cycles renderer.

Visit my complete on-line course
«**Rendering in Blender with Cycles Renderer**»
on Vysotskiy Consulting — BIM.VC.

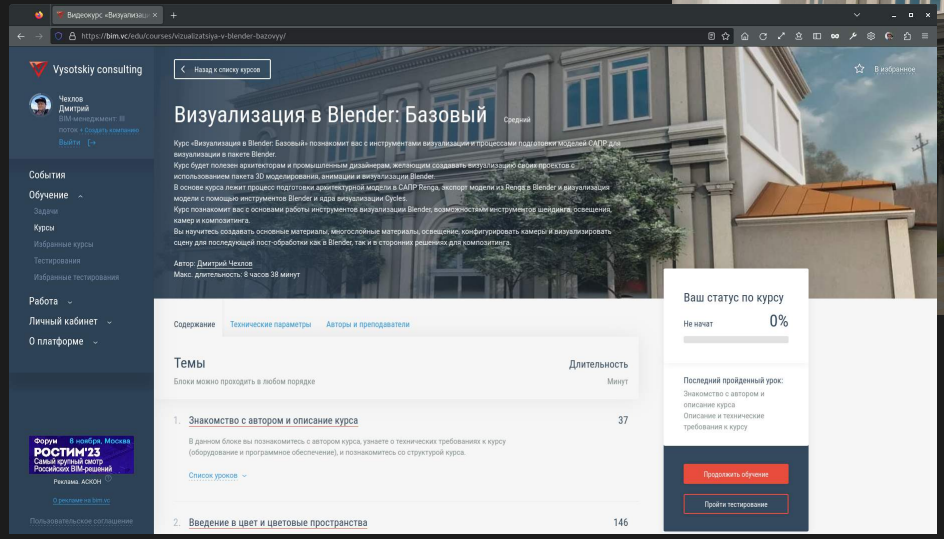


Image by Dmitry «dimson3d» Chekhlov from Course Project

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