Description and usage – IFC to 3D meshes

This document describes the use of a script converting IFC files to 3D meshes in the GitHub repository Testbed_BIM_GIS. The scripts are developed in the FME (Feature Manipulation Engine) version 2017.1 (Build 17539).

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History

Version	Date	Comments	Person
1.0	2018-06-21	First version of this document that describes the script	Tim Johansson

Converting IFC to mesh

This script converts an IFC file to 3D meshes using IfcConvert based on IfcOpenshell (http://ifcopenshell.org/). IfcConvert is a console application for converting IFC geometry into several file formats. The software is called inside FME using the system caller transformer and the process to call the application and read the results is automated. The IfcConvert version that is used in this script is IfcOpenShell 0.5.0 preview 2. The script is launched as custom transformers consist of a group of transformers. The different scripts using this method are:

- Script.fmw

Description

The overall architecture of the script is illustrated in the figure 1 and consists of the following parts:

1. The default FME IFC reader is used to read the IFC file to extract both the IFC attributes and the file location.
2. Creates a command by using the parameter input, which is mainly defined in the properties of the custom transformer. For instance this includes settings regarding world coordinates, generate Uvs, tolerance and precision for more info se the table 1.
3. The transformer “system caller” calls the console software IfcConverter and executes the command string.
4. A feature reader is used to read the geometries (obj file) which also are default include GUID.
5. The transformer feature merger is used to join the complete set of IFC attributes from the IFC file with the mesh generated from ifcConverter.

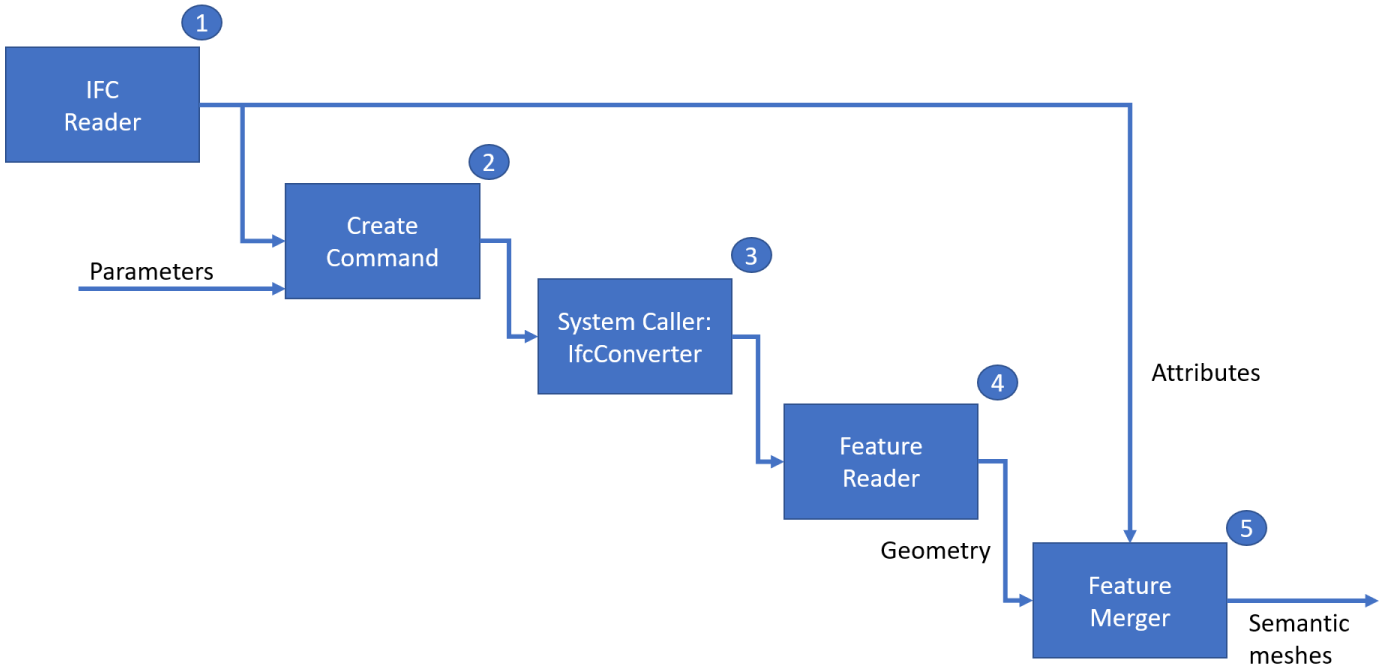
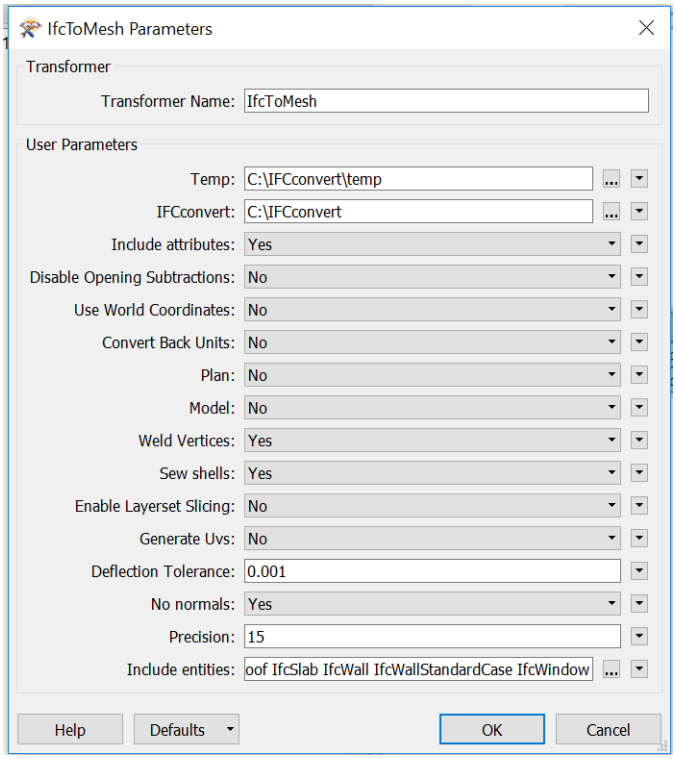


Figure 1: Shows the overall architcture

Parameters

The user of the ifcToMesh transformer need to specific a temp fold and the path to the IfcConvert.exe console software.



The other IfcConvert parameters is explained in table 1 taken from http://ifcopenshell.org/ifcconvert.html and from the help command in IfcConvert.

Table 1: Explains the different parameters in the custom transformer.

Options	***Explanation***
Plan	*Specifies whether to include curves in the output result. Typically these are representations of type Plan or Axis. Excluded by default*
Model	*Specifies whether to include surfaces and solids in the output result. Typically these are representations of type Body or Facetation. Included by default.*
Weld-vertices	*Specifies whether vertices are welded, meaning that the coordinates vector will only contain unique xyz-triplets. This results in a manifold mesh which is useful for modelling applications, but might result in unwanted shading artefacts in rendering applications.*
Use world-coords	*Specifies whether to apply the local placements of building elements directly to the coordinates of the representation mesh rather than to represent the local placement in the 4x3 matrix, which will in that case be the identity matrix.*
Convert-back-units	*Specifies whether to convert back geometrical output back to the unit of measure in which it is defined in the IFC file. Default is to use meters.*
Sew-shells	*Specifies whether to sew the faces of IfcConnectedFaceSets together. This is a potentially time consuming operation, but guarantees a consistent orientation of surface normals, even if the faces are not properly oriented in the IFC file.*
Merge-boolean-operands	*Specifies whether to merge all IfcOpeningElement operands into a single operand before applying the subtraction operation. This may introduce a performance improvement at the risk of failing, in which case the subtraction is applied one-by-one.*
Disable-opening-subtractions	*Specifies whether to disable the boolean subtraction of IfcOpeningElement Representations from their RelatingElements.*
Bounds arg	*Specifies the bounding rectangle, for example 512x512, to which the output will be scaled. Only used when converting to SVG.*
Include	*Specifies that the entitie that will be included*
Precision	*Sets the precision to be used to format floating-point values, 15 by default. Use a negative value to use the system's default precision (should be 6 typically). Applicable for OBJ and DAE output. For DAE output, value >= 15 means that up to 16 decimals are used, and any other value means that 6 or 7 decimals are used.*
No Normals	*Disables computation of normals. Saves time and file size and is useful in instances where you're going to recompute normals for the exported model in other modelling application in any case.*
Deflection tolerance	*Sets the deflection tolerance of the mesher, 1e-3 by default if not specified.*

Usage

The custom transformer has successfully been tested with the following settings according figure 2 but other settings may be used.

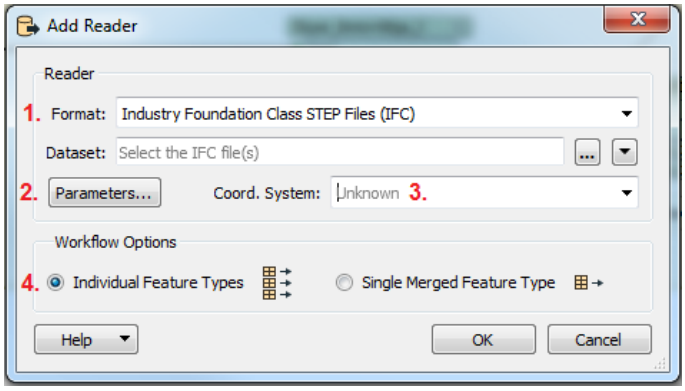


Figure 2: Shows reader options for an IFC-file.

1. The IFC model is read to the program with a *Reader* choosing the file format *Industry Foundation Class STEP Files (IFC)*.

2. Reader parameters are chosen as the shown in figure 3 below.

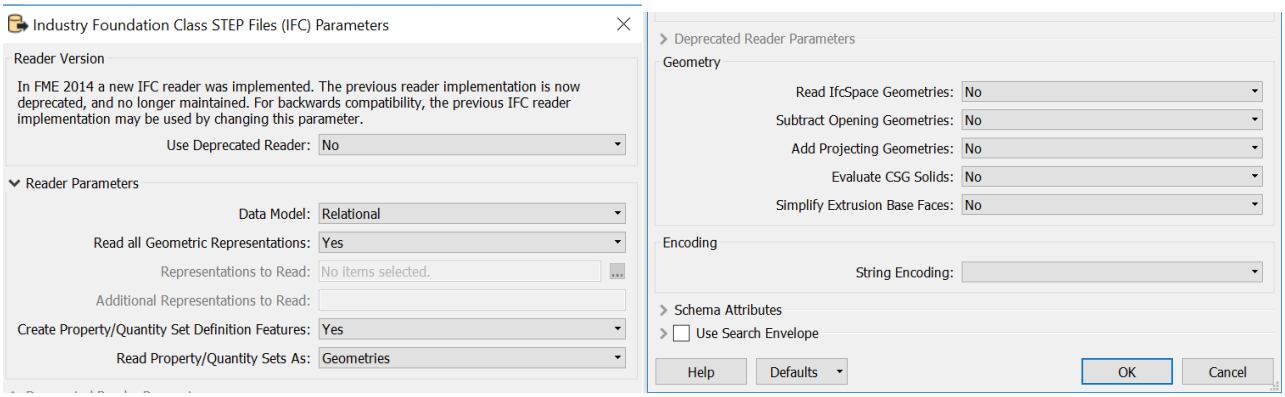


Figure 3: Shows the standard IFC parameters in FME desktop.

3. Coordinate system can be selected
4. To be able to handle different element *Individual Feature Types* is chosen.
5. Chose elements/features.

Click on the properties of the IfcToMesh transformer. Do the following:

1. Create a new temp folder or specify an existing folder.
2. Specify the path to IFCconvert folder. (Do not include application IfcConvert.exe in the path)