BETA SUITE

Embedded clips recognition by Machine Learning

ANSA
PRE PROCESSOR

EPILYSIS
SOLVER

META
POST PROCESSOR

KOMVOS
SDM CONSOLE

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1. Introduction

This document is a tutorial for the automatic embedded clips recognition and treatment in ANSA. The target of the document is to help the users become familiar with the ANSA capabilities and with the machine learning functionality related to fasteners recognition.

The user is guided through the DM building process. The tutorial contains all the necessary steps needed to identify embedded clips on parts, save the common representation (the actual geometry) and FE representation of fasteners in DM. This process is done once by the user. Following, the same DM library can be utilized to automate the recognition and treatment of embedded clips in new components, as shown in the second part of this tutorial.

The aforementioned functionality uses an already trained ML clips predictor that is provided in the ANSA installation package. However, in case that the existing predictor is not enough, users can train their own predictor using their own data and KOMVOS 4. Train ML Predictor with KOMVOS This predictor can then be connected with ANSA via DM.

1.1. Prerequisites

In order to exploit this functionality, first of all the user needs to have the special ML license credits that correspond to this add-on feature. Also, the user needs to download and install the 'ML Toolkit' (machine learning libraries). The toolkit can be downloaded from https://www.beta-cae.com and the installation can be found at "KOMVOS Installation Guide" chapter 6.

2. Build DM Library

2.1. Save common representation in DM

The first step that the user should perform in order to create a DM library with embedded clips is to save their common representation in DM. First of all, the user should mark the desired faces of the clips as fasteners inside **Feature Manager**.
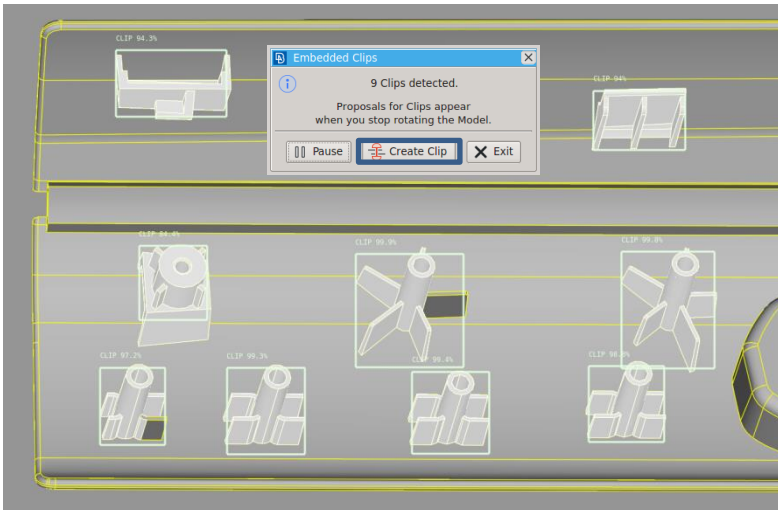

This can be facilitated with the use of **Utilities>Isolate> Embedded Clips**.

This function invokes the already trained clips predictor that exists inside ANSA and recognizes clips based on the current view of the part. Every time the user changes the view (move, rotate) the predictor will give a new result. "Create Clip" button automatically marks all the highlighted faces as fasteners inside **Feature Manager**.

Note! : The user can edit the faces that have been stored inside **Feature Manager** from **Feature Manager>Edit>Fasteners**.

When the proper faces are correctly stored inside **Feature Manager**, the user should save them in DM.
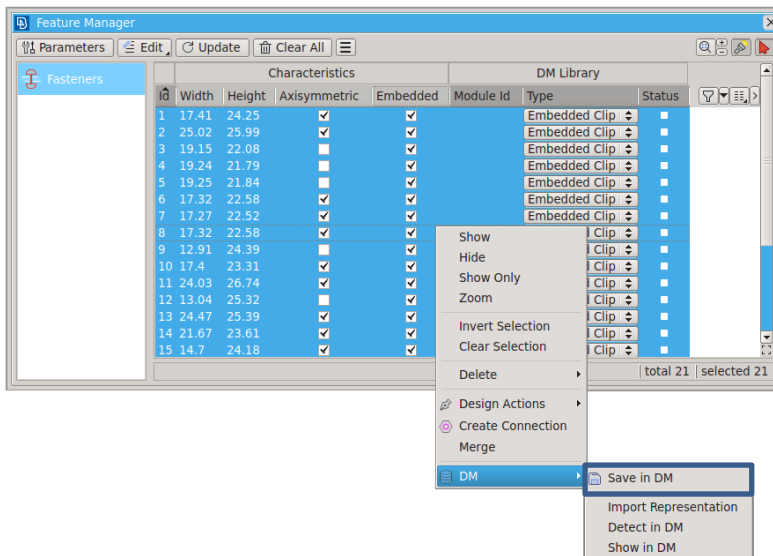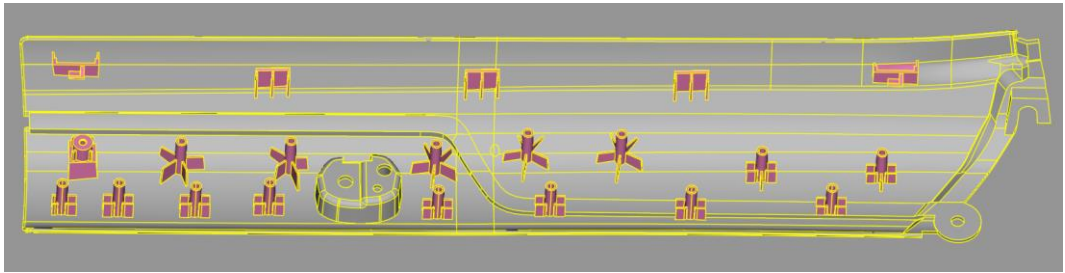

Select them all and use **RMB>DM>Save in DM**.

In the saving process through **Feature Manager**, similarity identification automatically runs. This means that if identical or very similar fasteners exist many times in the model, only one instance of them will be saved in the DM.
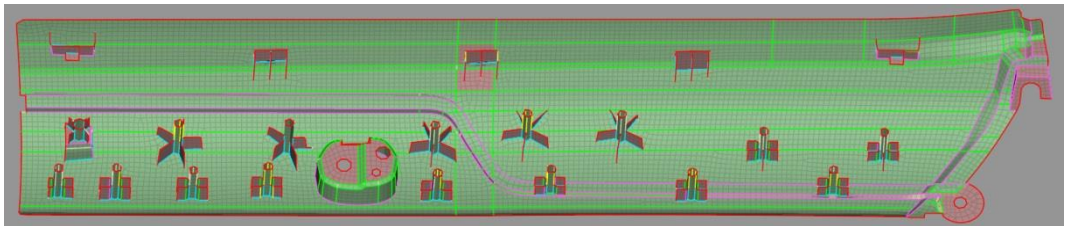
2.2. Save FE representation in DM

The user can also save in the DM respective FE representations for every fastener. This way, the desired representation can automatically be used in new components that have similar fasteners with those that exist in the DM.

The user should create an initial mesh result for the clips that meets his specifications and save it in DM.
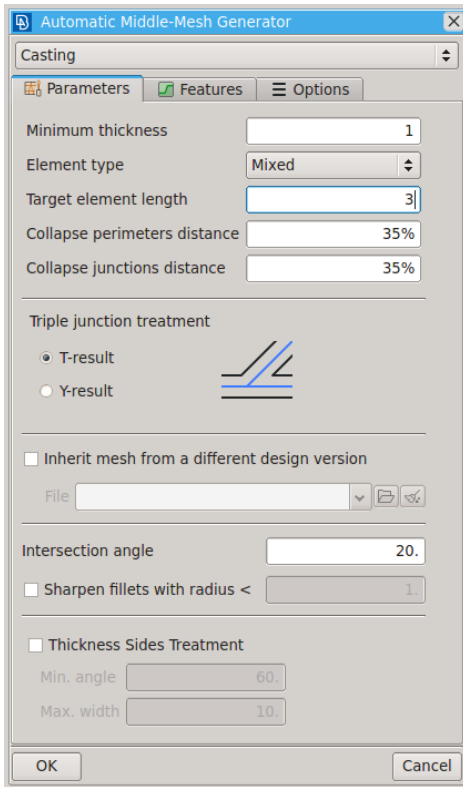
First, run **Casting** normally to the whole part. Then, fix the result of every fastener in order to fulfill the desired mesh criteria.

Note! : The "Fasteners treatment" option on "Features" tab of **Casting** should be disabled.

Finally, when the result is ready use the plugin **Build Fasteners Library>Add FE Representations.** With this plugin the user can easily define which elements correspond to every fastener feature and save them in the DM. For more information refer to the relative plugin document at "Documentation Index".

3. Utilize DM Library

As long as a DM library exists, the user can utilize it in new components to automatically recognize and treat the embedded clips.
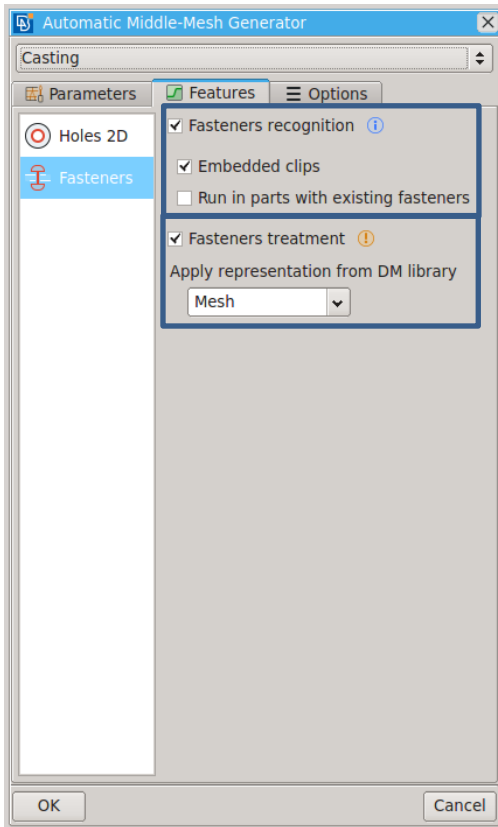
Through **Casting** function, the user is able to recognize and treat in batch mode the embedded clips of a part.

With the use of "Fasteners recognition" options, the user can recognize all the embedded clips on their model that are similar to those saved in the DM.

By enabling "Fasteners treatment" option and selecting the desired mesh representation name, **Casting** will produce mesh in the main part and reuse the mesh from DM. In more detail, the option "Fasteners treatment", will make **Casting** ignore all the fastener faces and will produce FE result only in the main body of the part. Selecting an FE representation name under "Apply representation from DM library" will automatically import the FE prepresentation from the DM and place it to the correct position for every fastener.

Note! : The recognition of the clips is also available through **Feature Manager** along with treatment actions like **Import Representation**.
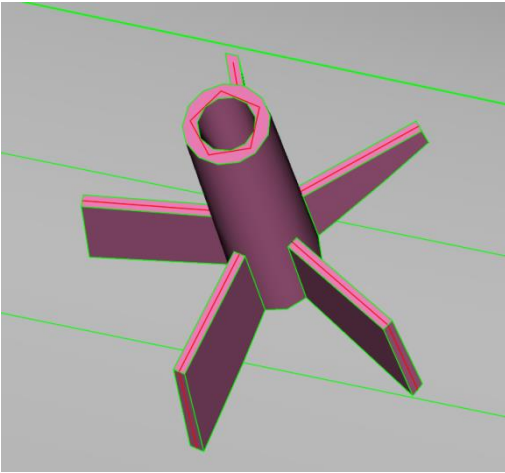
As a final step, the user needs to connect the merged FE result of the clips with the main body of the part with the use of the semi-automated function **Middle Mesh>Modify>Connect.**
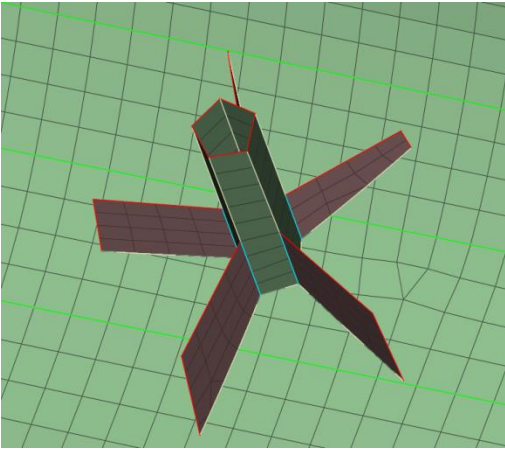
4. Train ML Predictor with KOMVOS

KOMVOS can be used to train an embedded clips predictor which can learn to recognize the clips that have been provided as input to the functionality. This predictor can be used within ANSA for the recognition of similar clips in new databases.

4.1. Prerequisites

This functionality can be utilized through SPDRM as long as KOMVOS and SPDRM have been connected. This way, the training can take place in a remote machine, depending on SPDRM configuration. Otherwise, the *(Local)* option will be available and the training will be performed in the local machine.
There is a minimum requirement of an NVIDIA 8GB GPU with CUDA 11, while the recommended would be 16 GB or more or VRAM.
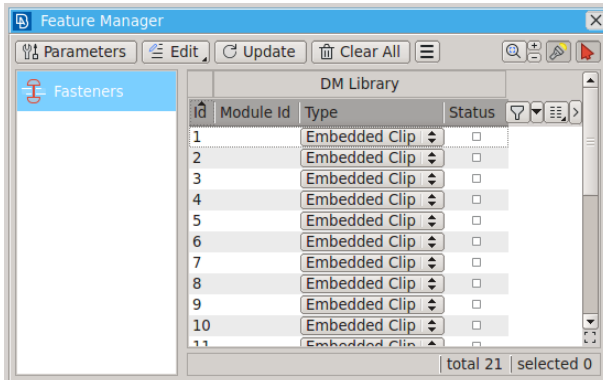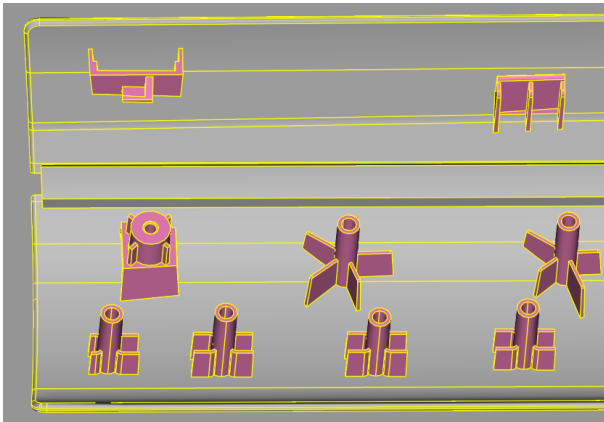
4.2. Train Predictor

Before the training of the predictor starts, the user should specify the following three paths:

1. Add/connect to a DM.

2. An ANSA executable under **Settings>BETA apps >ANSA>Path**.

3. A working directory under **Settings>Machine Learning Options>Working Directory.** This directory will be used for the output of temporary files. The directory should have at least 10 GB available and (fast) read/write access.
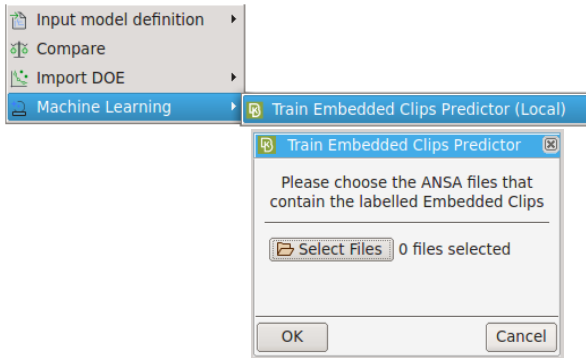
Then use **Machine Learning >Train Embedded Clips Predictor** and specify the files that will be used for the predictor's training. The files should be:

- ANSA databases.

- The databases should contain entire parts with embedded clips (Note! : The clips should be connected with the geometry of the part).

- The embedded clips should be marked as fastener feature entities inside **Feature Manager**. One feature entity should exist for every clip. Feature entities should exist for all clips, even for geometrically similar ones.
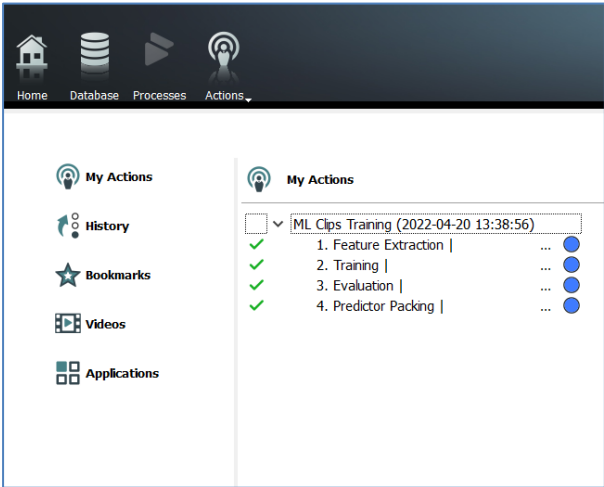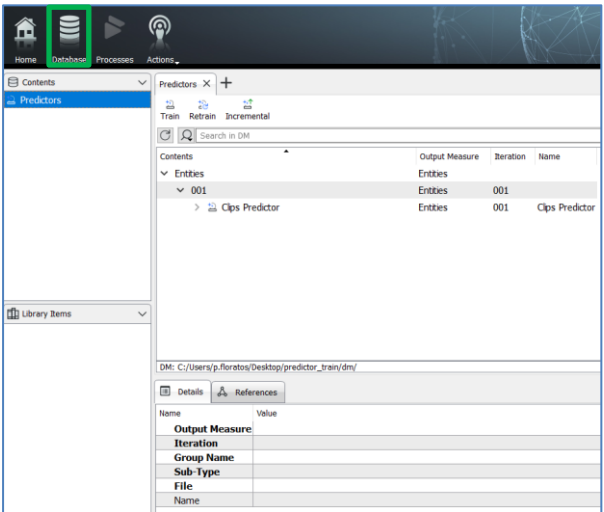
When the training is completed, the Clips Predictor will automatically be added in the connected DM and can be directly used in ANSA.

Open ANSA and set the DM that contains the predictor as DM path. **Utilities>Isolate>Embedded Clips** and **Fasteners Recognition>Embedded Clips** option from **Casting** and **Feature Manager**, will now use the user's predictor trained through KOMVOS.

physics on screen