New capabilities Simcenter Amesim 2310

Platform

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Agenda

Platform facilities [link]
Analysis tools [link]
Software interfaces [link]
1D-3D CAE [link]

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Platform facilities

Graph digitizer: multiple curves [link]

Simcenter Amesim Client for Git merge from branch [link]

Platform usability enhancements [link]

Graph digitizer: multiple curves

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Graph digitizer: multiple curves

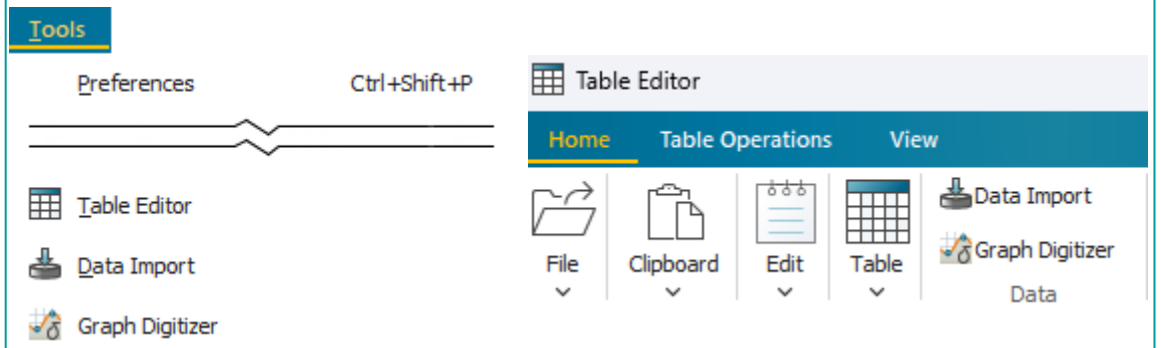
Go faster

Platform facilities

Data of multiple curves in the same image can be extracted

Extracted data can be saved as a Simcenter Amesim table file in multiple 1D formats or in M1D format

Access from main Tools menu or from Table Editor



Curve list creation

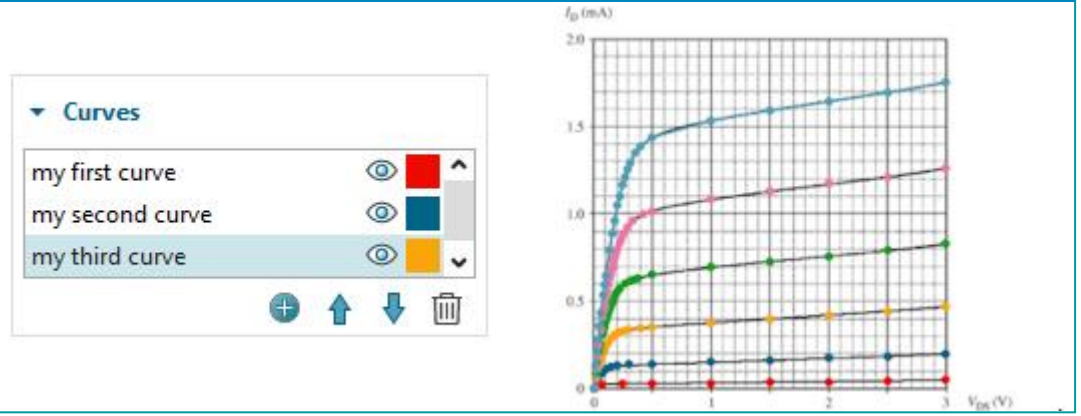
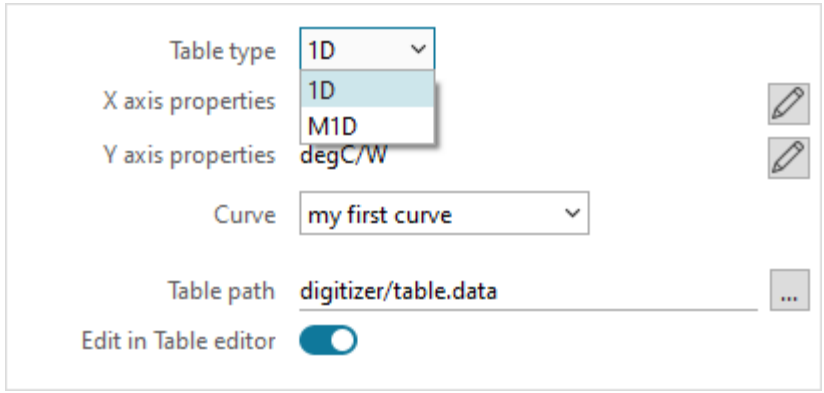


Table export



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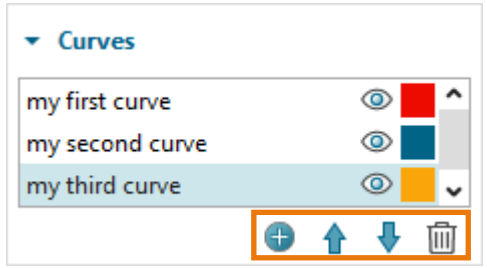
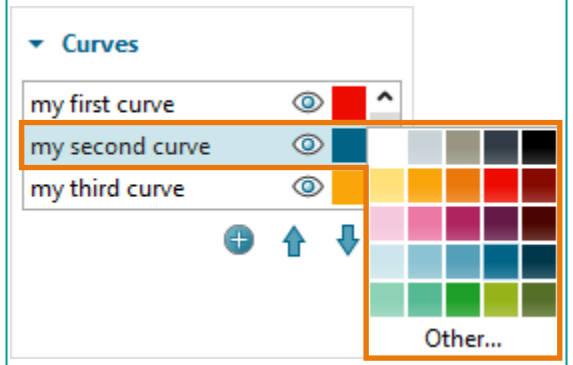
Graph digitizer: multiple curves

Go faster

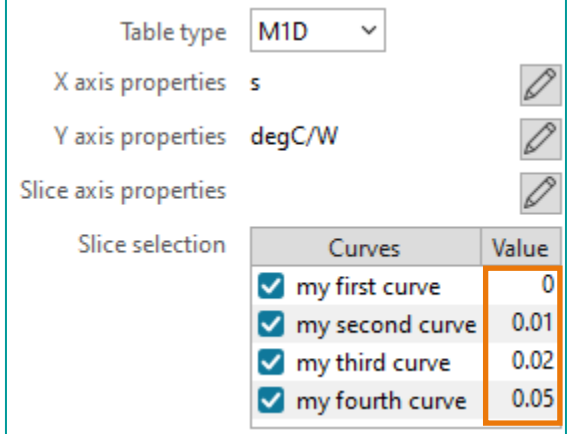
Curve list manipulation



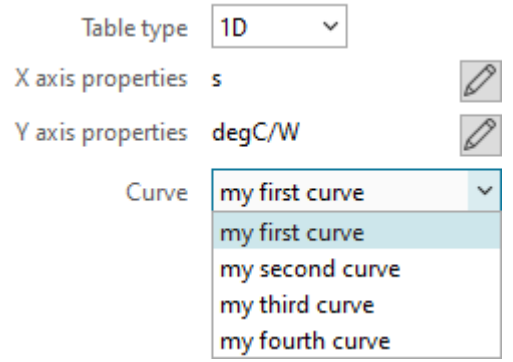
Curve properties



Third axis value setting



Curve selection for 1D



FEATURES

Curve list with add, remove and move position features

Customization of the display of curves in the image with title, color and show/hide options

Dedicated export settings for M1D table format

BENEFITS

Set the list of your curves in the correct way to manage the export to the desired table format

Visualize and identify the extracted data of the curves in the image

Define the properties of the exported table based on the extracted curves

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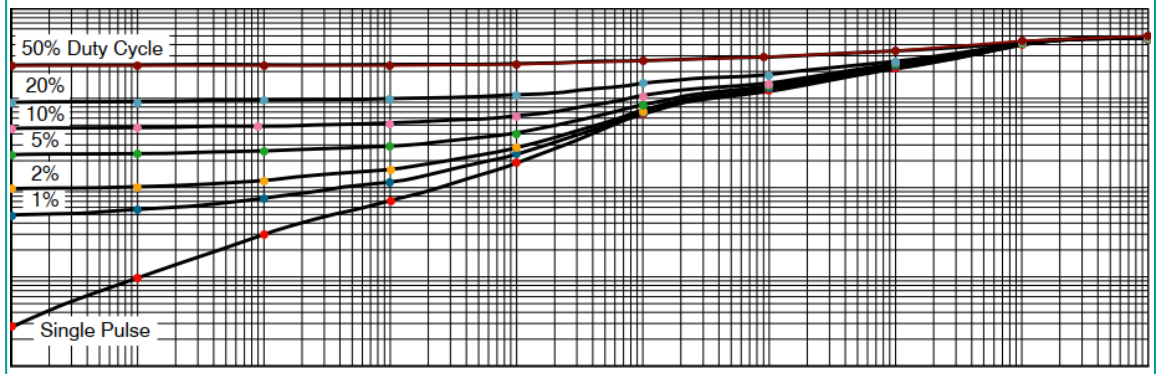
Graph digitizer: multiple curves

Go faster



Extract curve data

Table type	M1D
X axis properties	s, pulse time
Y axis properties	degC/W, Thermal resistance
Slice axis properties	null, Duty cycle

Slice selection

Curves	Value
single pulse	0
duty cycle 1%	0.01
duty cycle 2%	0.02
duty cycle 5%	0.05
duty cycle 10%	0.1
duty cycle 20%	0.2
duty cycle 50%	0.5

Table path: digitizer/table.data

Edit in Table editor

Set the properties for table creation

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Simcenter Amesim Client for Git merge from branch

Simcenter Amesim 2310

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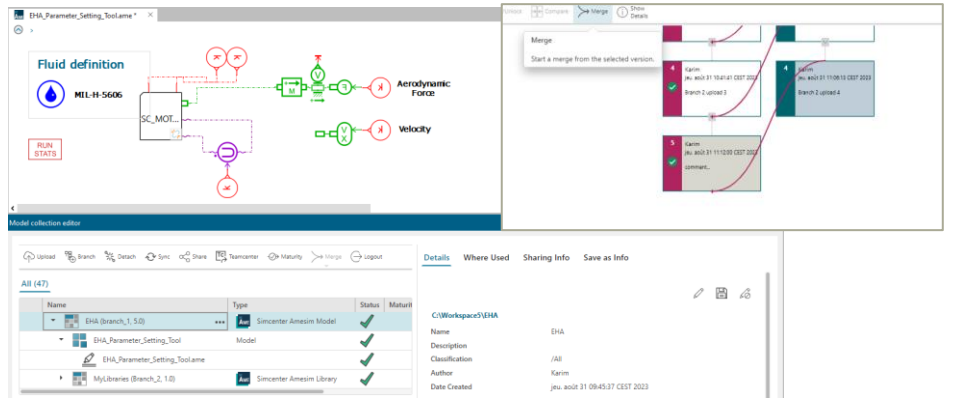
Simcenter System Simulation Client for Git merge from branch

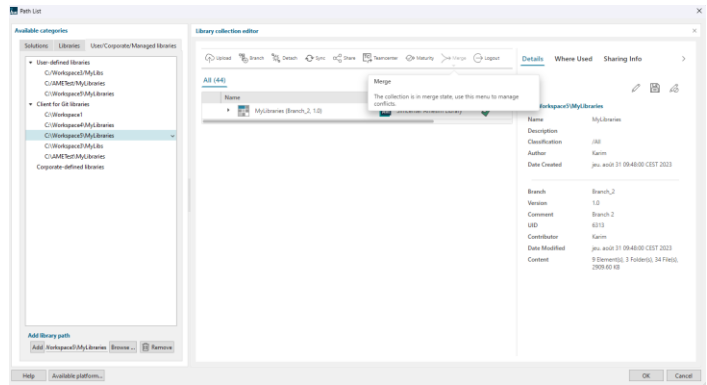
Platform facilities

1. Merge a Model collection containing data, files and libraries
2. Merge a Library collection containing data and files
3. Get an history view of the different merges

Merge collections in the Model Editor of Client for Git



Merge collections in the Library Editor of Client for Git



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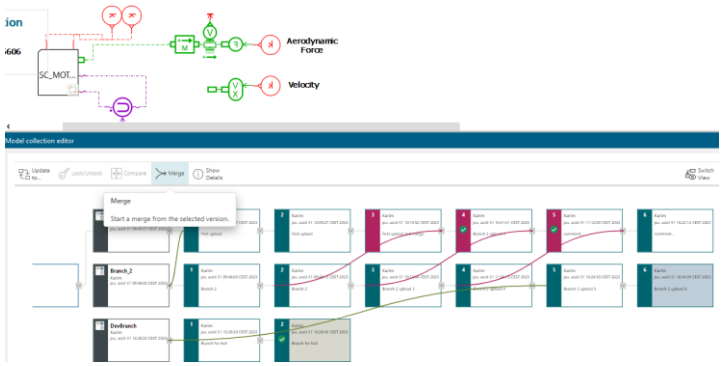
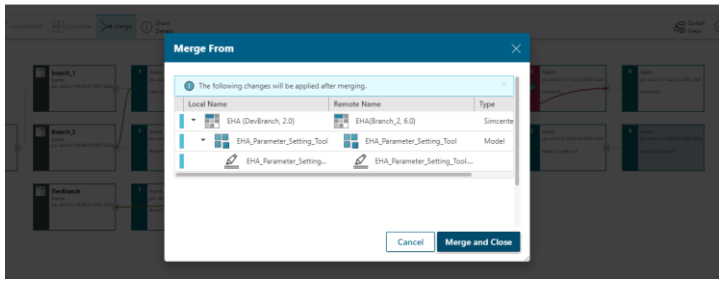
Merge a Model Collection from a branch

Stay integrated

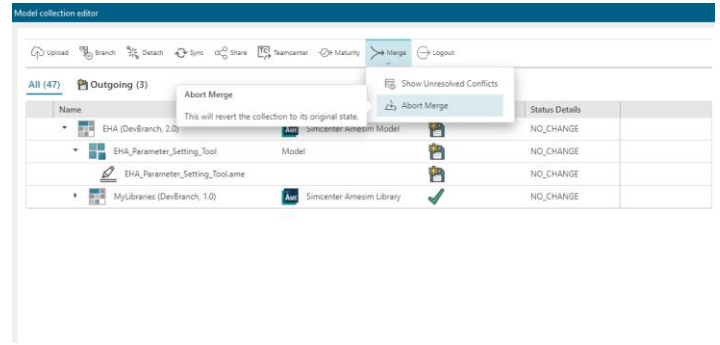
Select the version to merge



If no conflicts then merge



Abort the merge if necessary



FEATURES

- The merge workflow eases the parallel development of models
- The model can be merged with the data, the files and the associated libraries
- The merge can be aborted if necessary before an upload of the model collection

BENEFITS

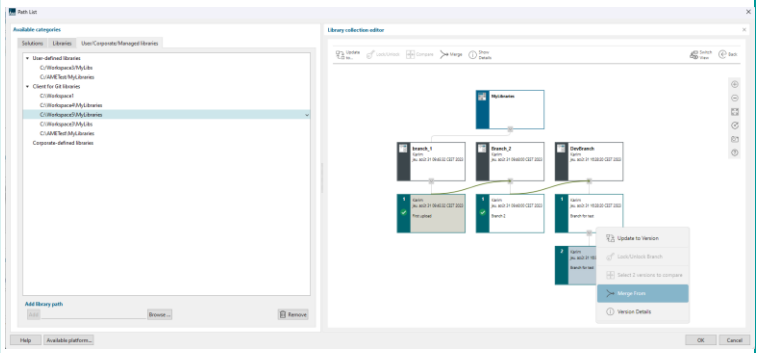
- Manage model changes in a structured and controlled way
- Collaborate effectively
- Maintain model with the associated data, files and library during the development lifecycle

SIEMENS

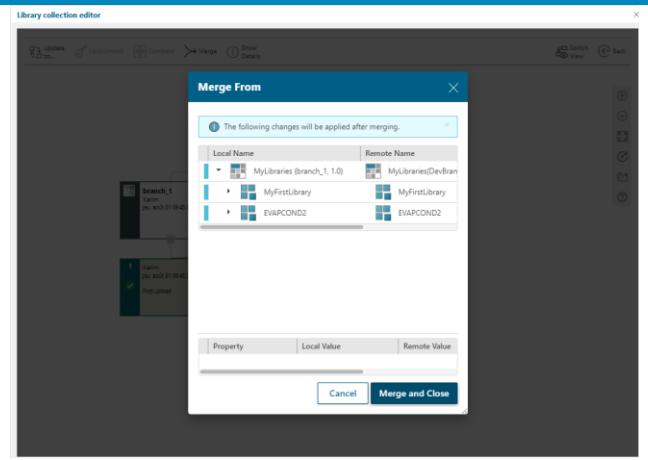
Merge a Library Collection from a branch

Stay integrated

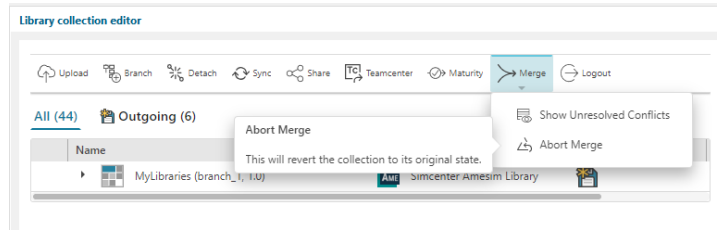
Select the library version to merge



Check the potential conflicts and merge



Abort the merge if necessary



FEATURES

- The merge workflow eases the parallel development of libraries
- The library can be merged with the associated data and files
- The merge can be aborted if necessary before an upload of the library collection

BENEFITS

- Manage library changes in a structured and controlled way
- Collaborate effectively
- Maintain libraries with the associated data and files during the development lifecycle

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Platform usability enhancements

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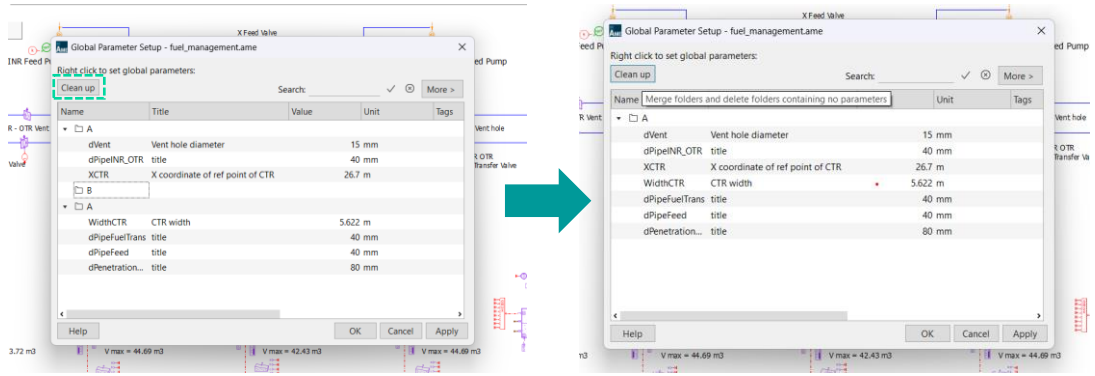
Platform usability enhancements

Platform facilities

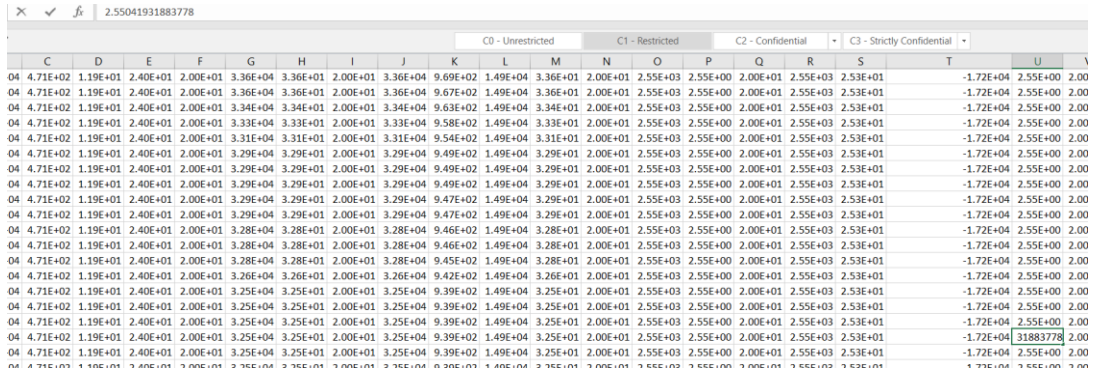
- New **Clean Up** button in the global parameter window automatically deletes empty folders and merges folders with the same name

- The precision of **.csv** files exported from results has been increased to match the precision of **.data** files

Clean-up button in the global parameter window



Precision of csv files



Analysis tools

Frequency Response Function Modal analysis [link]

Frequency Response Function Modal analysis

Simcenter Amesim 2310

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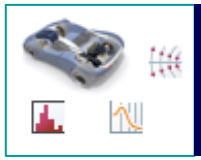
Frequency Response Function – modal analysis: tool enhancements

Explore the possibilities



Analysis tools

A new filter on the table of the top contributing states allows you to display those whose values are above the threshold of the participation factor entered.

The csv file export of Bode diagrams includes the result set number and the linearization time.

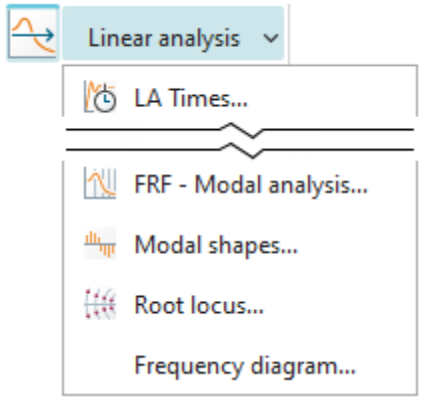
BENEFITS

Visualize the entire dataset for a better understanding of your system.

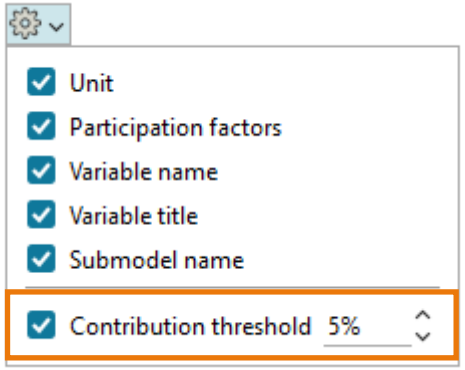
Focus on the data that matters.

Get better traceability of the exported data.

FRF – modal analysis



Top contributing states table settings



Additional comment in generated csv file

```
# Export CSV from Simcenter Amesim 2310
# Linearization time: 2s
# Result set: zeta=0.01  "1"
```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Software interfaces

Teamcenter: simulation process and data management [link]
FMI Reset (hot reinitialization) [link]
Support of adjoint derivatives in exported 3.0 FMUs [link]
Improved handling of pretrained neural networks (ONNX) [link]
User-defined default values for model inputs [link]

Teamcenter: simulation process and data management

Simcenter Amesim 2310

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Teamcenter: simulation process and data management

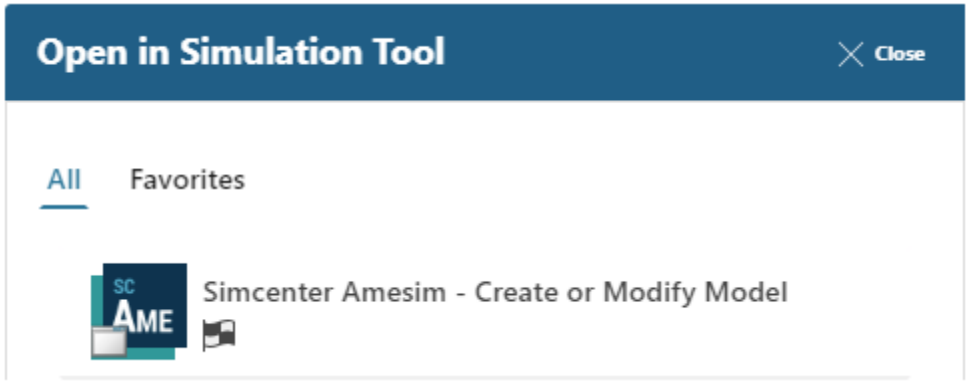
Stay integrated

Platform facilities

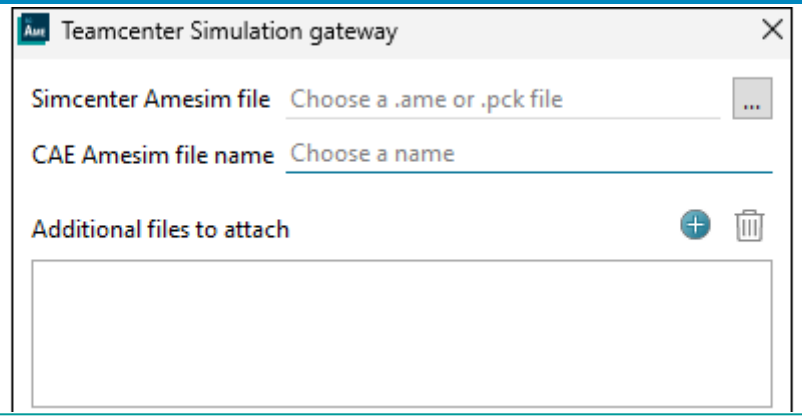
Manage models and their parameter mapping in Teamcenter from CAE 1D Model items

Perform simulations from the study definition of the related CAE 1D Analysis item

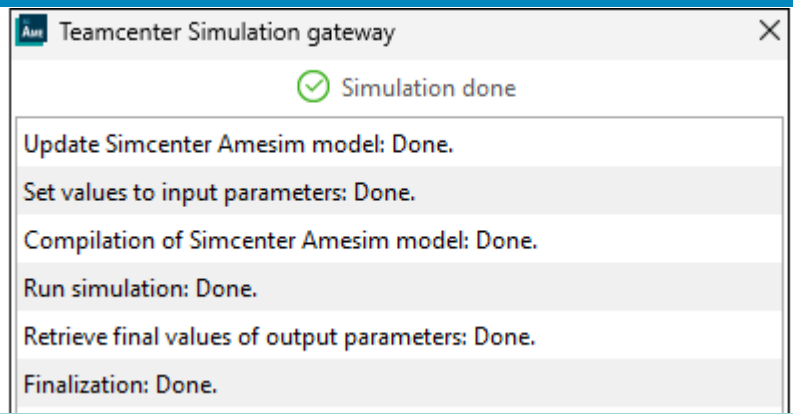
From simulation tools in Teamcenter



Dedicated gateway to manage CAE 1D model items



Dedicated gateway to manage CAE 1D analysis items



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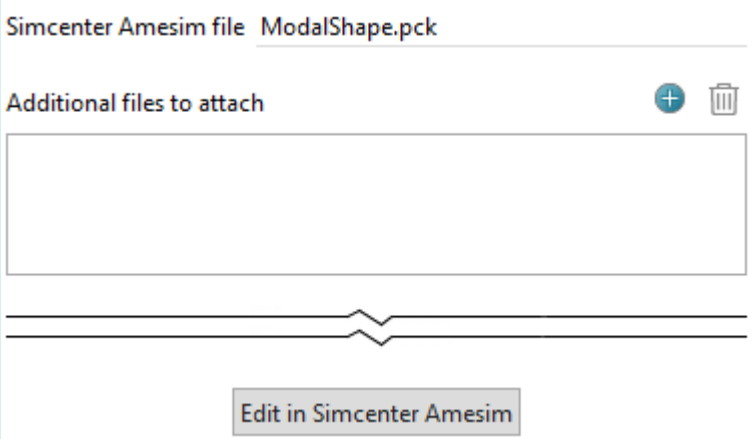
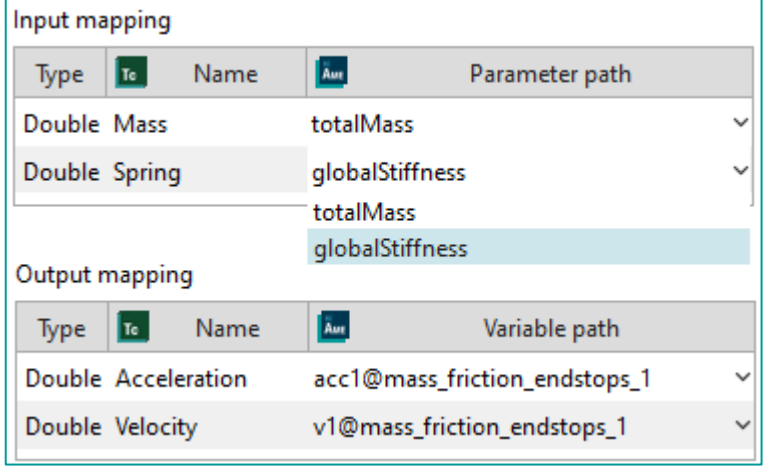
Teamcenter: simulation process and data management

Stay integrated

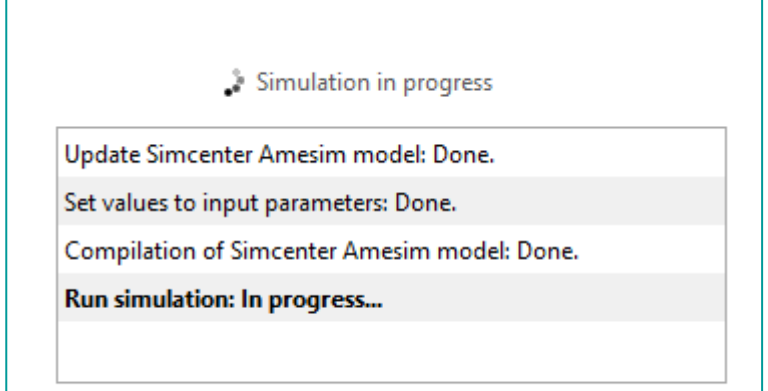
Define model and related files to be uploaded



Map parameters and variables with studies



Perform simulations and upload results



FEATURES

Dedicated interface to upload system simulation models into Teamcenter Active Workspace

Mapping between CAE 1D Model study parameters and watch parameters/variables of Simcenter Amesim models

Headless simulation run launch, and final result upload

BENEFITS

Get full traceability of system simulation models created from Simcenter Amesim

Build relationships between engineering data and models used for product development

Easily share results and insights

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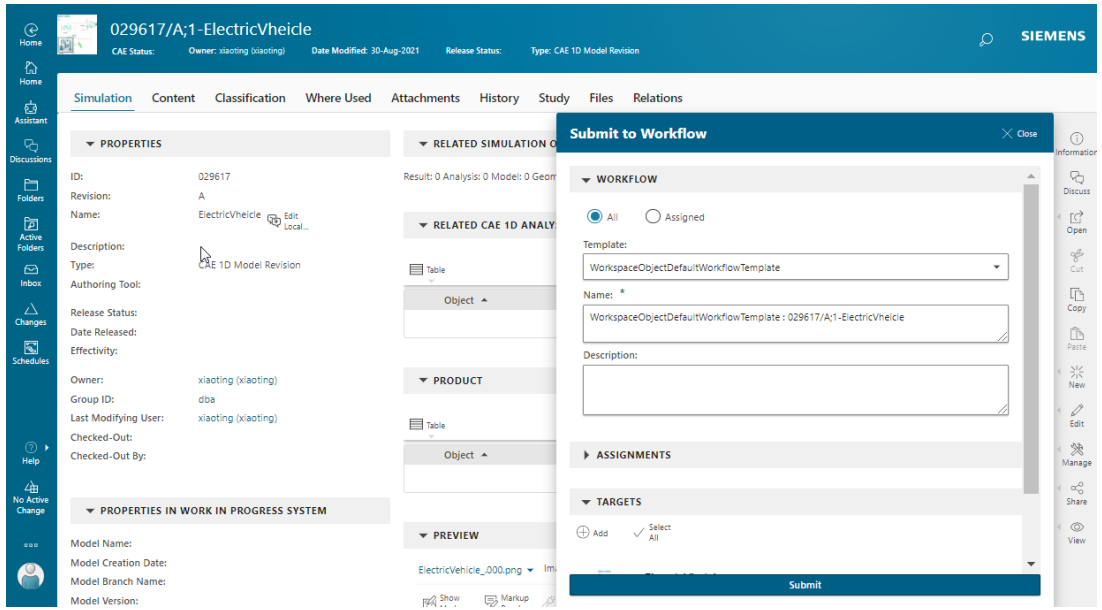
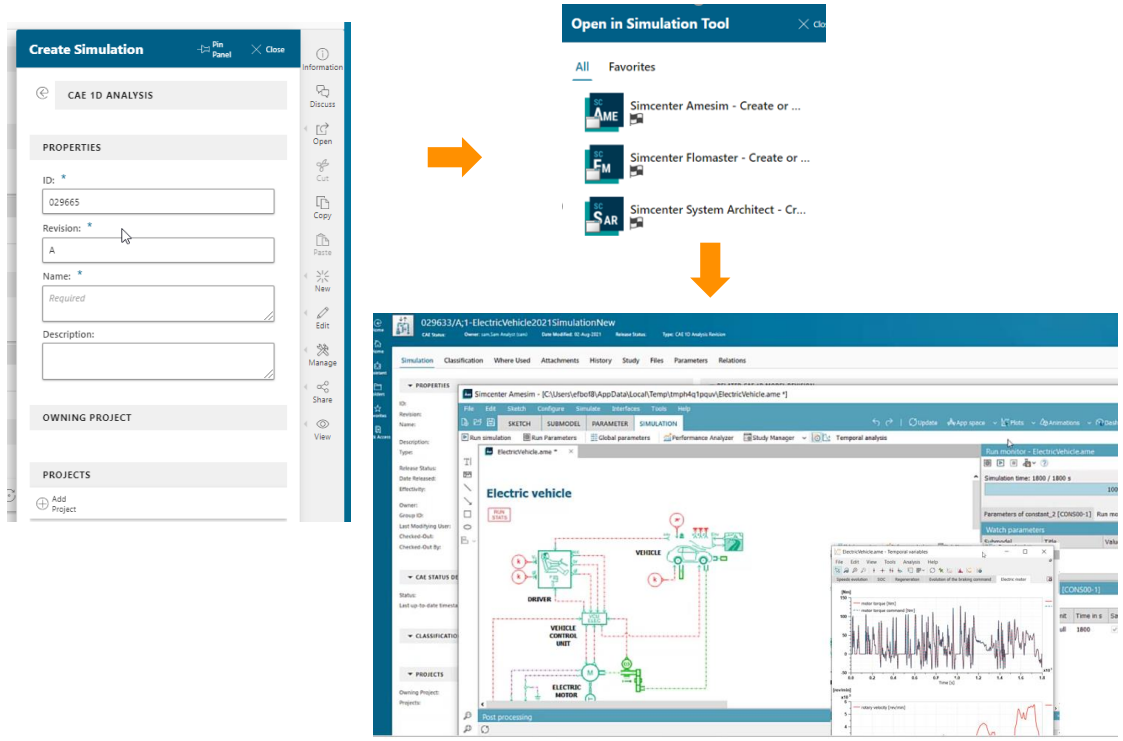
Teamcenter: simulation process and data management

Stay integrated



Simulation expert imports models to Teamcenter Active Workspace and releases them once study parameters are fully defined for sharing



Simulation analyst locates the released model, runs simulations based on the study definition and uploads the results to the analysis revision

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FMI Reset (hot reinitialization)

Simcenter Amesim 2310

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FMI Reset (hot reinitialization)

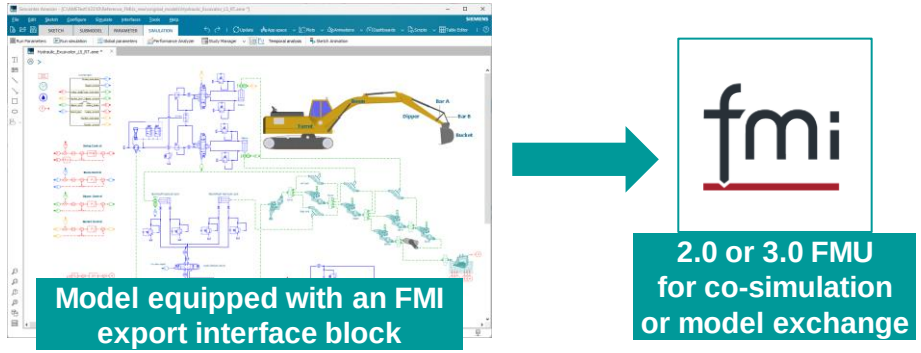
Software interfaces

- Exported 2.0 and 3.0 FMUs now comply with the so-called “FMI reset” function, which allows reinitializing the model without unloading it, optionally with new parameter values applied
- Usable with the vast majority of Simcenter Amesim libraries and/or submodels (only a few exceptions)

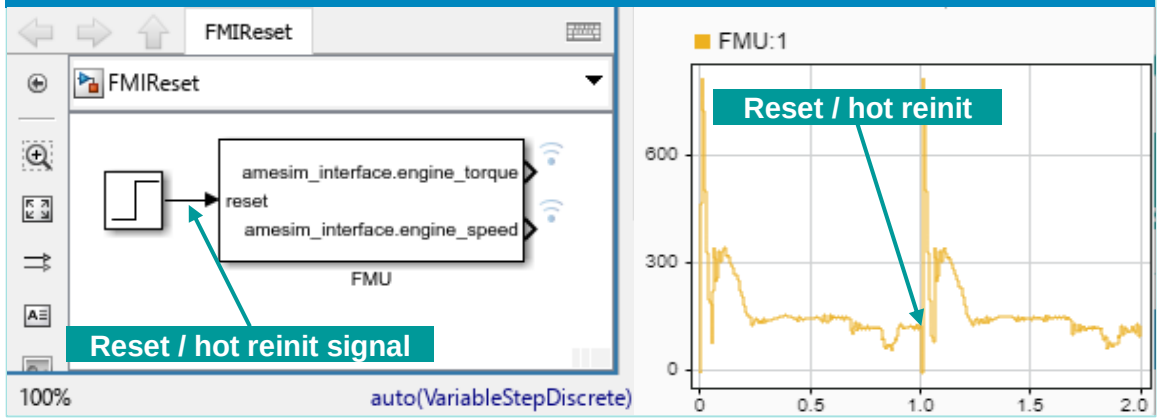
BENEFITS

- Avoid power-cycling your real-time target and/or sensitive hardware connected for reinitializing the model
- Chain various scenarios, maneuvers or load cases easily with deployed Simcenter Amesim models, thanks to an improved support of the FMI API

Export a Simcenter Amesim model as a 2.0 or 3.0 FMU as usual



An external FMI master tool can call FMI reset on the imported FMU



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Support of adjoint derivatives in exported 3.0 FMUs

Simcenter Amesim 2310

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Support of adjoint derivatives in exported 3.0 FMUs

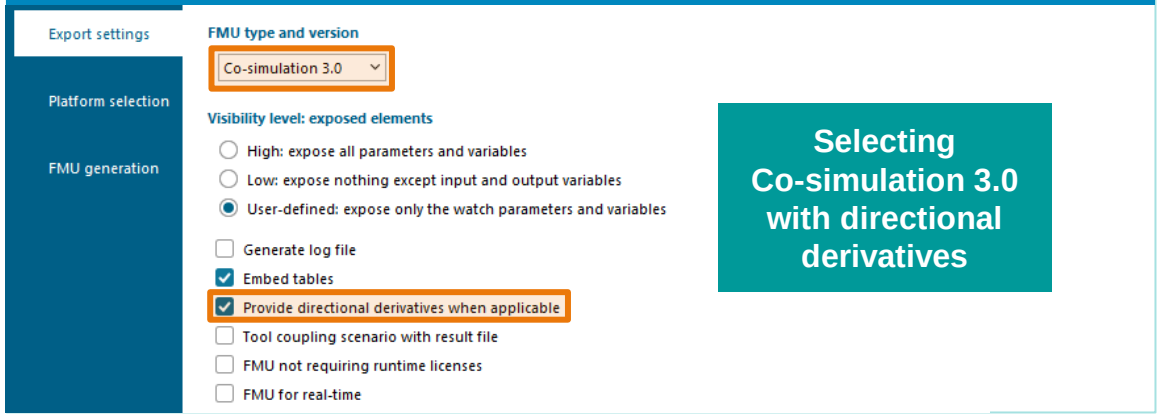
Software interfaces

- Exported 3.0 FMUs can now optionally provide the adjoint derivatives, in addition to the directional derivatives, which is typically needed for backpropagation in gradient-based training of artificial intelligence (AI) models

BENEFITS

- Encapsulate and train more efficiently artificial intelligence (AI) models with Simcenter Amesim 3.0 FMUs
- Connect the system simulation world to the Python/Julia tool world more easily
- Enable the combination of physics-based and AI-based models (e.g. neural ODEs) and training in a unified framework

Export a Simcenter Amesim model as 3.0 FMU as in release 2304



Selecting Co-simulation 3.0 with directional derivatives

An FMI 3.0 master tool can call the ”fmi3GetAdjointDerivative” function

```
<CoSimulation modelIdentifier="quadcopter_main"
needsExecutionTool="false"
canBeInstantiatedOnlyOncePerProcess="true"
canGetAndSetFMUstate="false" canSerializeFMUstate="false"
providesDirectionalDerivatives="true"
providesAdjointDerivatives="true"
providesPerElementDependencies="false"
providesEvaluateDiscreteStates="false"
canHandleVariableCommunicationStepSize="true"
maxOutputDerivativeOrder="0"
recommendedIntermediateInputSmoothness="0"
providesIntermediateUpdate="false"
mightReturnEarlyFromDoStep="true"
canReturnEarlyAfterIntermediateUpdate="false"
hasEventMode="false"/>
```

Capability flag set to “true” in the exported 3.0 FMU

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Improved handling of pretrained neural networks (ONNX)

Simcenter Amesim 2310

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Improved handling of pretrained neural networks (ONNX)

Stay integrated

Software interfaces

- Added support for 9 additional ONNX nodes: Expand, Slice, Unsqueeze, Neg, Gemm, Cast, Shape, Gather and Constant
- This applies to the Neural Network Import app (or its underlying ONNX2Ame script), and to the ONNX2FMU and ONNX2SFun scripts that convert ONNX files to either FMUs or S-functions

BENEFITS

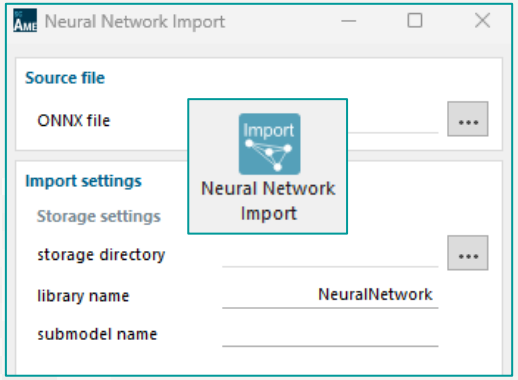
- Improved import of pretrained neural networks for model reduction/hybridization purposes within Simcenter Amesim
- Improved conversion of neural networks as lightweight FMUs or S-functions for the deployment of surrogate models
- Better compatibility with the Simcenter ROM Builder, Tensorflow, Pytorch, Julia or other ONNX compatible software

List of currently supported ONNX nodes for surrogate modeling

Abs	Constant	Gemm	LSTM	Relu	Slice	Sub
Add	Elu	GRU	MatMul	RNN	Softplus	Tanh
Clip	Exp	HardSigmoid	Mul	Reshape	Softsign	Transpose
Cast	Expand	Identity	Neg	Shape	Split	ThresholdedRelu
Concat	Gather	LeakyRelu	Pow	Sigmoid	Squeeze	Unsqueeze

ONNX operators useful for system simulation

Use of ONNX scripts to import or convert pretrained neural networks



ONNXToAme
ONNXToFMI
ONNXToSFun

SIEMENS

User-defined default values for model inputs

Simcenter Amesim 2310

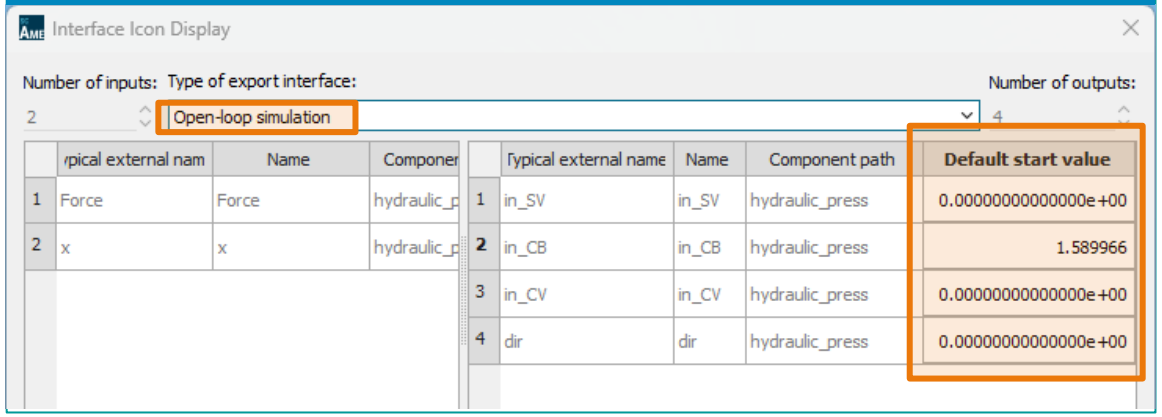
SIEMENS

User-defined default values for model inputs

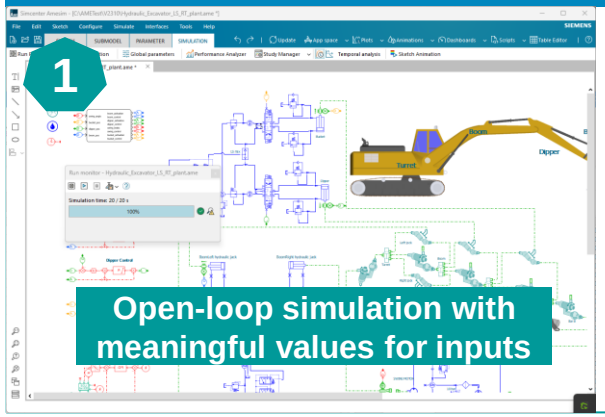
Software interfaces

- Meaningful constant values can now be defined as default inputs of models intended for export
- This greatly improves the “open-loop simulation” interface, used for validation, when non-null quantities, such as absolute temperatures or pressures, are expected at model inputs
- These values also get stored in exported FMUs as default start values for model inputs. If more convenient, FMI importing tools may reuse them silently with a higher degree of confidence than with previous hard-coded zeros

New column for changeable start values in the Interface Status window

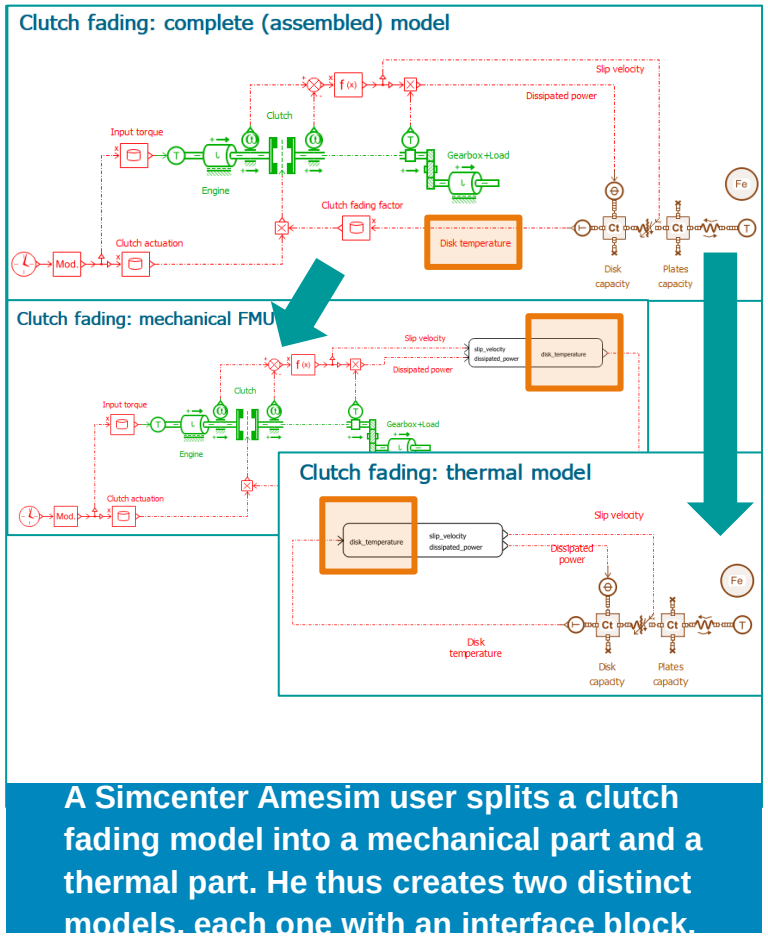


Start values stored in FMUs silently reusable by FMI importing tools

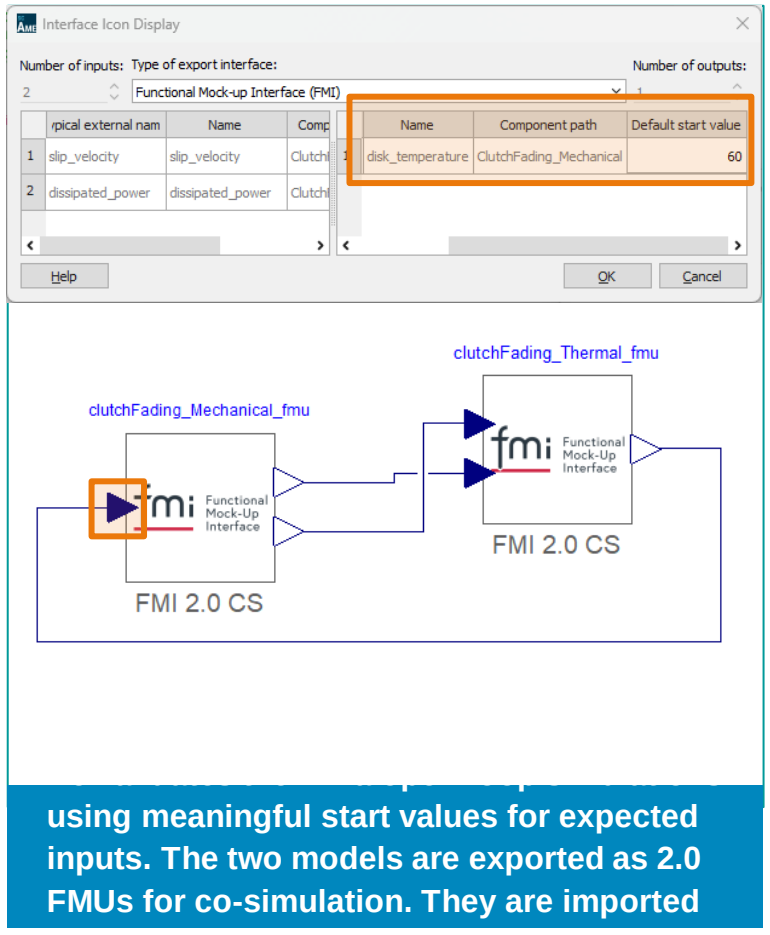


Exported FMU with default start values stored

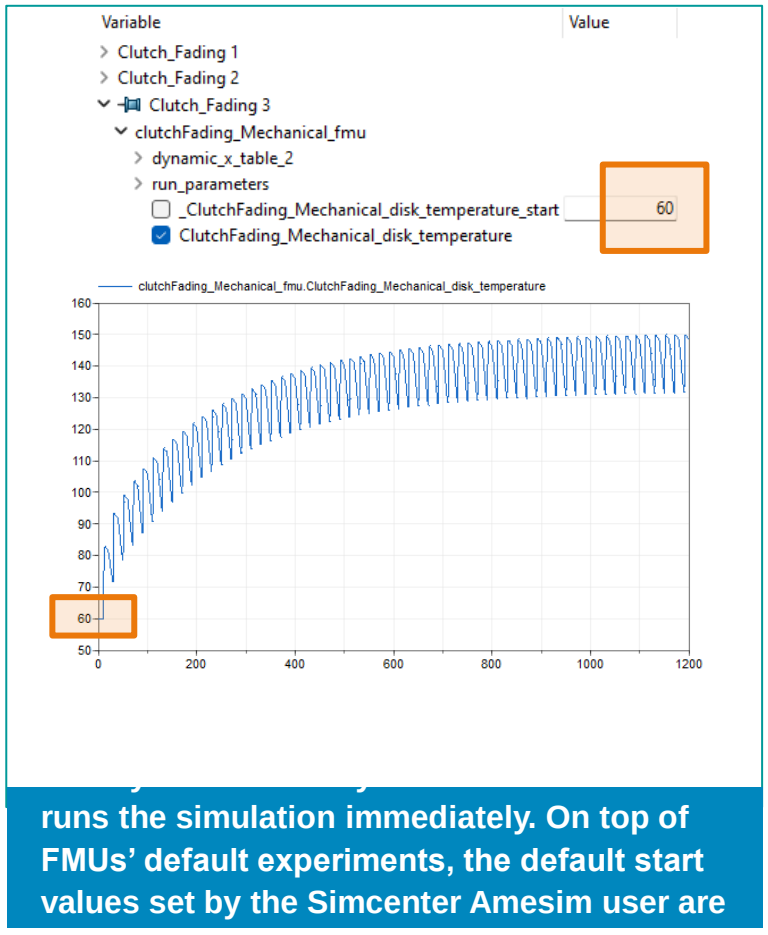
More robust “lazy” initialization of co-simulated Simcenter Amesim FMUs within FMI importing tools (Dymola example)



A Simcenter Amesim user splits a clutch fading model into a mechanical part and a thermal part. He thus creates two distinct models, each one with an interface block.



using meaningful start values for expected inputs. The two models are exported as 2.0 FMUs for co-simulation. They are imported



runs the simulation immediately. On top of FMUs’ default experiments, the default start values set by the Simcenter Amesim user are

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1D-3D CAE

CAD Import: model upgrade [link]

CAD Import: model upgrade

Simcenter Amesim 2310

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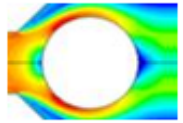
CAD Import: model upgrade



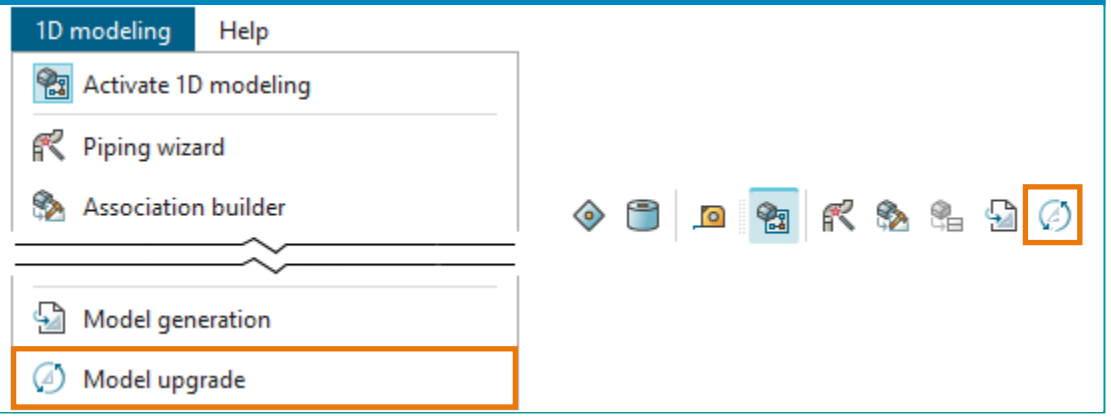
1D 3D CAE

This feature allows you to apply modifications from a system description of a new 3D CAD parts revision to an existing system model.

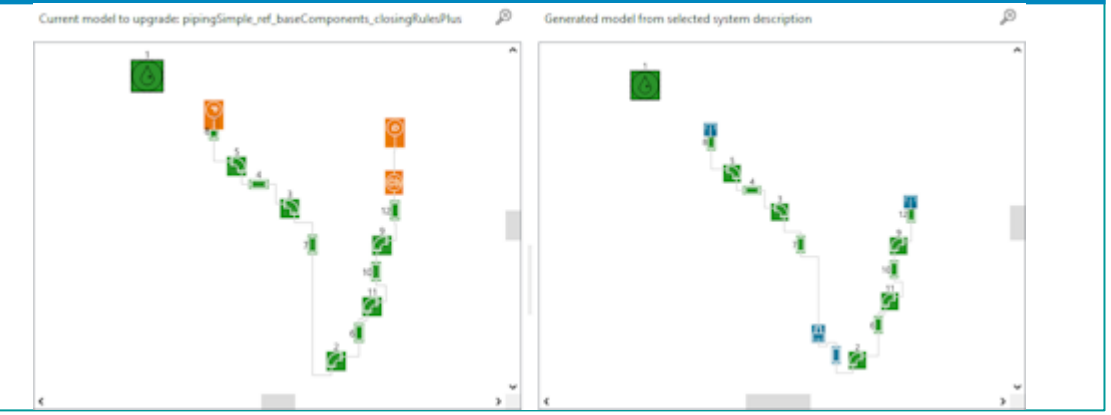
A compare stage provides sketch views to highlight the differences between the current system model to upgrade and the system model generated from the new 3D CAD system description.

The final stage is a preview of the system model resulting from the merge of all modifications.

From the 1D modeling menubar and toolbar



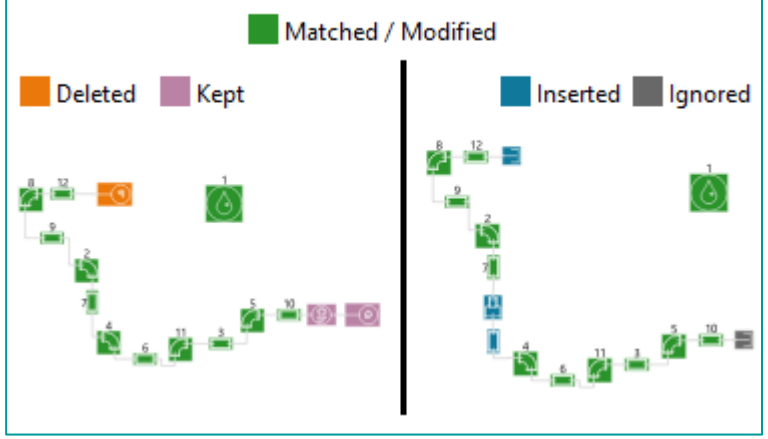
Compare system models before upgrading



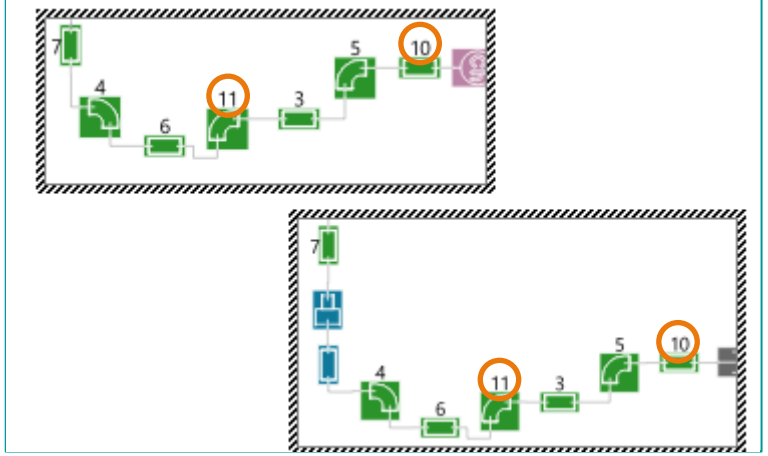
CAD Import: model upgrade

Stay integrated

Component status



Match component numbering



Parameter comparison

Title	Value
center angle of the bend	30.386
diameter	14.448
index of hydraulic fluid	1
curvature radius of the bend	47.625

Title	Value
center angle of the bend	30.386
diameter	20.45
index of hydraulic fluid	1
curvature radius of the bend	47.625

FEATURES

Color-coding of component highlights according to their status.

Numbering of matched components in both views.

Display of parameter lists when matched components are selected.

Preview of the system model resulting from the merge.

BENEFITS

Identify how components are interpreted for the merge.

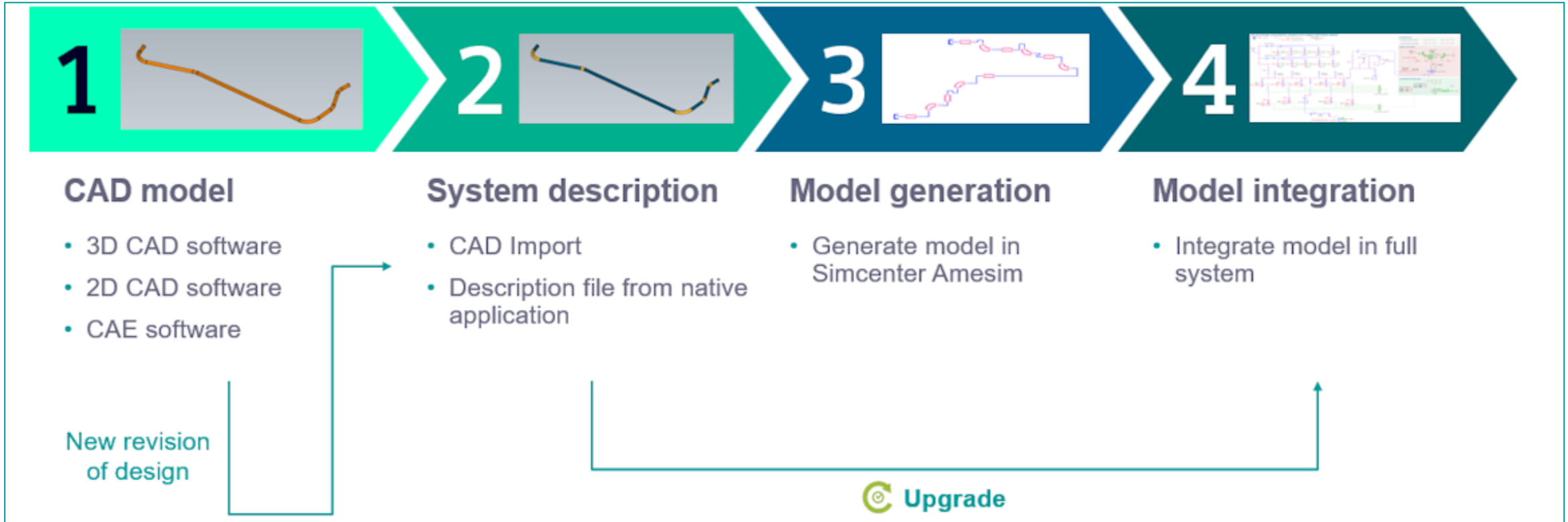
Spot pairs of components on the sketch views.

Compare parameter values between components of a pair.

Check system model changes before applying the merge to your model.

SIEMENS

CAD Import: model upgrade



Once a system engineer receives the new design revision, he or she needs to describe the system by associating primitives in CAD Import. Then instead of generating the corresponding model in a temporary file, the changes can be applied directly to the full system.