
SIEMENS
Ingenuity for life
Version
2021.3
Siemens Digital Industries Software
Simcenter STAR-CCM+
Release Notes
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Contents

Simcenter STAR-CCM+ Release Notes 2021.3

This document provides important information about Simcenter STAR-CCM+ 2021.3.

Contents:

New Features and Enhancements in Simcenter STAR-CCM+ 2021.3

Enhancements to Simcenter STAR-CCM+ 2021.3 are presented by category:

Top new features and enhancements for this release are:

- Improved battery electro-thermal analysis workflow
- Meshfree DEM
- Anisotropic near wall meshing
- Parallel core advancing layer mesher
- CGNS workflow improvements
- Lighthill wave model
- Eigenvalue analysis for normal modes in solid mechanics
- Circumferentially averaged profile plots
- Xcelerator Share
- Smaller .simh files through compression

Contents:

Platform

Xcelerator Share

- **Overview**
  - Xcelerator Share is a collaboration platform accessible within Simcenter STAR-CCM+ via an embedded browser
    - Exposure of Xcelerator Share within the Simcenter STAR-CCM+ user interface requires a license
    - To obtain a license, contact your Siemens Digital Industries Software account manager
  - To log into the collaborative platform, you require an Xcelerator Share account, which is created directly by your organization
- **Basic capabilities**
  - Create projects and folders to manage and organize content for collaborators

- Share projects with either internal or external collaborators
  - Access levels can be set on a per-project basis to address security concerns
- File Upload to Cloud/Download to local resources
  - Files can be uploaded to either:
    - Xcelerator Share account home folder
    - Projects and/or folders within projects
  - Files selected for download are compressed and unarchived when download is complete
  - Download status is displayed in the Xcelerator Share Downloads window
- View and markup for CAD files
  - CAD files can be selected from any project and viewed interactively
  - Tools are available to add text annotations, obtain dimensions and add markups
- Working with downloaded files
  - Downloaded Simcenter STAR-CCM+ .sim files are opened via the **Open Simulation** button in the Downloads window
  - For CAD content, a **Copy Path** button places the fully resolved file location and name in the paste buffer
    - Provides a consistent workflow to add CAD files wherever they are needed in your simulation efforts

Deployment

- **Certified operating systems (OS)**
  - RHEL 7.9, Amazon Linux 2, HPE Cray OS (supported)
- **Retired operating systems**
  - CentOS 7.4
- **Scheduled operating systems support changes for Simcenter STAR-CCM+ 2022.1**
  - Adding: RHEL/Rocky 8.4, OpenSUSE Leap 15.3 SLES 15 SP3, Cloud Linux 8
  - Adding: Windows 10 21H1, 21H2
  - Retiring: CentOS/RHEL 7.7, 8.0, 8.1, CentOS 8.2, openSUSE Leap 15, 15.1, SLES 12 SP3, SP4, 15, 15 SP1
  - Retiring: Windows 10 1903, 1909, 20H1, Server 2012
- **Retired Message Passing Interface (MPI) versions**
  - Platform MPI 9.1.4.4 (LINUX and Windows)
- **Scheduled Message Passing Interface versions for Simcenter STAR-CCM+ 2022.1**
  - Adding: Intel 2021.2 (Windows)
  - Retiring: Intel MPI 2019.7 (LINUX)

CAD Integration

CAD-Clients

- **Updates**
  - *Support for Siemens NX Version 1980 is added in the Simcenter STAR-CCM+ 2021.2 B release

CAD Clients	Version
Siemens NX/Simcenter 3D	Windows up to NX 1980* **Linux NX 12 to 1953**
Inventor 2021	**Windows 2021**

Key: **New** No change

CAD-Exchange

- **Updates**
  - *Support for Siemens NX Version 1980 is added in the Simcenter STAR-CCM+ 2021.2 B release

Siemens CAD Reader	Version
Siemens NX	Up to NX 1980*

HOOPS CAD Reader	Version
Siemens NX	Up to NX 1926
CATIA V5	**Up to V5-R2020**
Inventor	Up to 2021
ACIS	Up to 2020

Key: **New** No change

Geometry

3D-CAD

- **Export 3D-CAD model D2854, D898, D2750, D5376, D5500, D4321**
  - Easily collaborate on geometry preparation by transfering entire 3D-CAD model between .sim files
    - Export Parametric CAD option is added on the 3D-CAD Model node in the simulation tree
    - Creates CAD file and a separate java file with all the features from 3D-CAD
    - Suppress, Rollback, failed features not exported
- **Move face**
  - Parameterize imported geometry for design study
    - Move a collection of faces in a linear, angular, or radial direction
    - Use Overflow Behavior options to define output behavior for overlapping faces
- **Face selection**
  - Improved productivity through a faster selection of complex or multiple faces for geometry preparation
    - Select interior face to easily select faces from holes, pockets, and ribs for defeature faces operation
    - Tangent face selection by holding the shift key to select continuous fillets
- **Support tessellated geometries in 3D-CAD**
  - Faster geometry organization for tessellation imported into 3D-CAD
    - Import facet data format as stl, JT Tessellation, and dbs files

        - Use the search tool, section cut, and explode view to organize geometry
        - Easily distinguish between facet bodies and sheets in the tree through different icons
        - Transfer facet data as mesh part for further mesh pipeline operation
- **Light weight display**
    - Faster interaction and visualization with low tessellation representation
        - Recommended to use for assemblies of 10 000 bodies or more
        - Global option, off by default
        - Import and feature execution time have seen up to 2x speedup
- **Unite/Subtract diagnostic tools**
    - Quickly locate the possible source of errors for unite operation failures
        - Failure location highlighted when selecting the failed feature
        - All possible failures are highligthed
        - Global option to change highlight color
- **Retain visualization data**
    - Faster access to 3D-CAD model in an existing .sim file through global option to retain visualization data
        - Avoid tessellation when opening a 3D-CAD model
        - Increased file size compared to the original CAD due to storing tessellation for visualization
- **Face normal - Extend edge**
    - Faster method to close gap between sheet bodies
    - Use the existing edge to move the face in the normal direction
- **Refit - Repair Faces**
    - Remove invalidities in the imported geometry for a better success rate of downstream operations like unite, sew, etc.
- **Transfer CAD as Mesh parts**
    - Faster method to transfer data from 3D-CAD to parts since the tesselation data is lighter compared to the CAD
        - Transfer CAD data as mesh part for further mesh pipeline operation
        - CAD associativity is not maintained with the parts
- **Expression support in panel**
    - Easier assignment of parameters in all 3D-CAD feature panels for design studies
        - Convert coordinate system into a single field to assign a vector
        - Parameters created from the panel are highlighted in green
        - Tool-tip to indicate the current values for expression fields
- **Additional 3D-CAD features**
    - Triad to control orientation for rotate, revolve, extend solid, and move face features
    - Create axis with origin and direction option
    - Tolerance option in shell, thicken, and extend solid features
    - Allow imprint option in subtract feature
    - Tolerance option to control find similar feature output in the search tool

Parts

- **Transform coordinate system D3056**
    - Improved automated template workflow by allowing coordinate system to be transformed with parts
        - Always creates a new coordinate system

        - Newly created coordinate system is located under the parent coordinate node
- **Offset operation - Parts based shells**
    - Create offset surface around shell parts
        - Option to include the source part with contact to the output shell
- **Retain descriptions after deleting parts**
    - Improved automated template workflow by retaining the description when all parts are deleted

Mesh

Surface Repair

- **Improved visual effectiveness through better Scene defaults**
    - New palette colors automatically applied for:
        - Color by distinguishing part, patch, part surface, etc
        - Assign color while creating part and part surface
        - Color for source and target in feature panel

Volume Mesh

- **Parallel core advancing layer mesher**
    - Faster generation of polyhedral meshes with advancing layer mesher
        - Core mesh generation is now parallelized
        - Consistent mesh across different core counts
        - Up to 3.6x faster for 32 cores (case-dependent)
- **Anisotropic near wall meshing**
    - Increased simulation throughput through fast and efficient anisotropic meshing
        - Efficient mesh distribution to capture high curvature geometry
        - Faster mesh generation and lower memory usage through reduced overall mesh count
    - Anisotropic meshing is enabled through intuitive custom curve controls
    - Available for advancing layer mesher with polyhedral or tetrahedral cells
    - Applications: Fixed & rotary wing aircraft, propeller blades, wind turbines
- **Select part surfaces in morph surface mesh operation**
    - Robust mesh deformation through improved assignment of part surfaces
        - Previously the entire part was used for morphing which could lead to undesired displacements at adjacent boundaries that were not supposed to deform
        - Now individual part surfaces can be included or excluded from the morph surface mesh operation
        - Applications: Shape optimization studies
    - **Directed mesher performance improvements**
        - Faster mesh generation for serial directed mesher
            - Up to 3x faster (case-dependent)

CAE Integration

- CGNS Workflow improvements
    - Increased co-simulation productivity through CGNS workflow enhancements

        - Fluid and structural teams can work independently
            - Fluid team generates the CGNS data source(s)
            - Structural team leverages an automated and robust CGNS workflow to generate structural results
    - Key improvements
        - New Map after Import option
        - A Default Data Mapper is created on import
        - Mapping from CGNS to native regions is automatic
        - Time interpolation is now possible when mapping
        - Surface or Volume parts (but not both) can be selected

Physics

Contents:

CFD

Flow

- **PISO with face flux updates at each corrector step**
    - Up to 1.15x overall solution speedup for LES gas turbine combustion and in-cylinder simulations due to algorithmic changes in the PISO solver
- **Segregated solver speedup for constant value species**
    - Improved efficiency of combustion solutions by not solving the species field when constant
        - Up to 1.3x overall speedup for in-cylinder simulations
    - The new algorithm skips unnecessary calculations in the Segregated Species Solver when the species solution is trivial, for example when:
        - There is no convection or diffusion
        - There is no evaporation or dilution
    - Speedup is proportional to the number of species
- **Coupled species compatibility with non-reflecting boundary condition**
    - Accurate representation of hot gases in turbine blade aerodynamics by accounting for coupled species in the non-reflecting boundary condition
    - Improved convergence in multi-component turbine simulations when using non-reflecting boundary condition
- **User specified motion activation with Activate/Deactivate workflows**
    - Improved user experience in multi-timescale simulations with motion thanks to Motion Always Active option

- Choose if motion is to be activated in an inactive continuum
- Previously motion was always activated for active and inactive continua

Note: Caution needs to be taken when motion is activated in inactive continua as use of large time-steps might induce errors

- **Expression input for under-relaxation factor (URF) and CFL ramps D5532**
  - Improved flexibility for templating and design exploration studies by allowing expression inputs for URF and CFL ramps, and turbulent viscosity solver URF
  - Reduced need for scripting and easier use of Simulation Operations with global parameters
  - Allows the use of design exploration for optimum setup in terms of speed and robustness

Energy

- **New external radiation workflow**
  - More intuitive and less error-prone setup of simulations with external radiation thanks to consolidated workflow
    - A region-based option can now activate external radiation on all boundaries of the region
      - Minimizes risks of incorrect setups, for instance where boundaries are left out by mistake
    - Wall thermal condition Environment merged into Convection
      - The Thermal Resistance option is now activated by the Convection condition
      - External radiation can now be enforced in addition to other thermal boundary conditions
    - Surface Orientation option has been retired, Radiation Transfer option now offers choice for making a region radiate only internally, or only externally, or both (dual)
      - Dual sided option was previously not available

- **Radiation contribution per part D3663**
  - More meaningful post-processing of radiative results with Surface-to-Surface, by allowing more granularity in visualizing radiation fields
    - New workflow allows to filter radiation contribution that is generated only from a subset of sources or reaching only a subset of targets
    - The source and target selection is Parts-based
  - Useful for identifying root-cause of thermal hotspots due to radiation and for designing preventive thermal screens

Reacting Flows

- **Improved reaction zone sensor for Flamelet Generated Manifold (FGM) with Thickened Flame Model (TFM)**
  - Improved accuracy of FGM-TFM simulations with new Progress Variable Reaction Rate (PVRR) definition for reaction zone sensor
    - TFM active only around the flame front
    - Avoid changing mixing outside of flame region
    - Complements already available Progress Variable and User Defined options for reaction zone sensor
- **Flamelet table interpolation optimization**
  - Faster turnaround time for flamelet simulations with table interpolation improvement
    - Up to 1.3x speedup
    - Applicable to all flamelet models

- **Ignitor definition from geometry parts D2846**
  - Reduced set-up time through easier ignitor definition using any geometry Part as input
    - Previously, only simple Volume Shapes (Block, Cone, Cylinder, Sphere), could be used as inputs
    - Applicable to any reacting flow simulation that requires an ignitor
  - Flexible ignitor positions with geometry operations
    - Ignitor positions can be configured to follow geometric changes for example during design space exploration
- **Coagulation source scaling for Soot Moments and Soot Sectional models**
  - Improved soot particle size distribution through possibility to scale coagulation source term
    - Complimentary option to existing Surface-growth, Nucleation, and Oxidation Scales
- **Progress Variable field function in temporary storage for Complex Chemistry with Turbulent Flame Closure (CC-TFC)**
  - Clearer post-processing options with move of Progress Variable field function in temporary storage
    - Recommended practice to use other CC-TFC reaction product mass fractions to monitor simulation

Multiphase Flow

Volume of Fluid (VOF)

- **Transition Manager for resolved VOF-Lagrangian (LMP) transition model**
  - Improved ease of use for hybrid multiphase provided through a new manager for VOF to LMP transition
    - Previously all criteria had to be contained in a single field function
  - Manage multiple criteria for transition based on
    - Blob diameter (predefined)
    - Blob shape (predefined)
    - User criteria (arbitrary field function)
  - On creating a resolved VOF-LMP phase interaction, two criteria are generated automatically
    - Blob diameter (default range 1e-6m to 1e-3m)
    - Blob shape (Sphericity > 0.7, Inertia Tensor Eigenvalue Ratio > 0.8)
    - These can be changed, deleted, or added to

Mixture Multiphase (MMP)

- **Wall/bulk boiling for MMP**
  - More accurate boiling simulations
    - Include more of the physics of boiling with a comprehensive family of sub-models to capture all relevant phenomena
    - More accurate than correlation based models such as Rohsenow which work well for some applications but not others
  - Reduced computational cost compared to Eulerian Multiphase (EMP) for appropriate cases
    - Previously wall/bulk boiling models only available for EMP
    - Allows you to use cheaper MMP model for boiling
  - Unal sub-model for wall bubble departure diameter suitable for wide range of system pressure levels including low pressure applications

Two-Phase Thermodynamic Equilibrium Model

- **Improvements to Drift Flux Model**
  - Improved stability provided by additional controls for the Drift Flux model
    - Under-Relaxation Factor (URF) - Explicit under-relaxation of drift flux sources
    - Max Acceleration Change - Maximum acceleration magnitude change per iteration due to drift flux

Eulerian Multiphase (EMP)

- **Adaptive time-step providers for EMP**
  - Improved ease of use with additional time-step providers reduce solution time for certain categories of simulations
    - You no longer need to determine a time-step size that will be stable and maintain accuracy throughout a transient run
      - Allows larger mean time-step to be run
      - Three new providers:
        * Smoothed Convective CFL

          As previously available outside of EMP
        * LSI Smoothed Convective CFL

          Available when ADIS scheme selected

          Only considers CFL in vicinity of the free surface
        * Free Surface

          As previously available for VOF
- **Source smoothing for Fluid Film stripping into Eulerian Multiphase (EMP)**
  - Improved stability and reduced computational expense
    - Previously mass stripped from Fluid Film only added to near wall cell
      - Could overload cell in case of thin prism layers and lead to limiting of stripped mass
      - Mitigation was a small time-step size to avoid associated instability
    - Now mass can be spread over several cells with source smoothing approach
      - Analogous to using larger cell for Fluid Film stripping
        * Typically minimum cost in terms of accuracy as mesh density is aimed at other physics
  - Improved ease of use
    - Avoids need to design mesh specifically for Fluid Film stripping
      - Mesh can be designed for continuous fluid with low y+ without impacting stripping
- **Compatibility of EMP Phase Coupled Energy and Fluid Film**
  - Model heat transfer between Fluid Film phases and EMP phases
    - Basic compatibility of Phase Coupled Energy with Fluid Film is provided
    - Includes transfer of energy via Fluid Film impingement and stripping
  - Limitation:
    - Phase interaction models between the Fluid Film and EMP phases including energy transfer (such as evaporation) not supported

Dispersed Multiphase (DMP)

- **S-Gamma population balance model for DMP**
  - Accurately predicts droplet/bubble size distributions for dispersed phases
    - Includes physics such as breakup and coalescence

- Reduced computational cost compared to MMP and EMP approaches
  - DMP is a lightweight model for low volume fractions
  - Easily added to a single phase modeling strategy
  - Available with the Coupled Solver
  - Can be carried out as post-processing step
- Benefits applications such as vehicle water management and aircraft icing

Fluid Film

- **Turbulence for Fluid Film**
  - Improved accuracy for industrial problems with Fluid Film
    - For many applications the film can be in the turbulent regime
    - Particularly relevant for thick films
    - Previously Fluid Film could only be modeled as Laminar
  - Turbulent viscosity is modeled algebraically, there are three options:
    - Cioncolini model - suited to annular flows
    - Mudawwar model - suited to heated films
    - Field Function
- **Fluid Film solver options for PISO**
  - Reduced computational expense when using Fluid Film with PISO
    - Fluid Film update frequency now has options that are more efficient for PISO
    - No need to update Fluid Film during every PISO corrector step/iteration
    - Three options provided:
      - First and Last Iteration
      - Last Iteration
      - Every Iteration - Previous behavior and approach used for SIMPLE

Lagrangian Multiphase (LMP)

- **Support for bubbles in resolved VOF-Lagrangian transition model D1541**
  - Speed benefits of hybrid multiphase approach available for wider range of applications
    - Formation of bubbles is resolved with VOF
    - Subsequent tracking done with Lagrangian
  - Combines adaptive mesh refinement with cell clustering to balance accuracy and turnaround time
  - Available for single component gas

Discrete Element Method (DEM)

- **Meshfree DEM D3651**
  - Improved ease of use with new workflow for simulations where DEM interaction with fluid flow can be neglected
    - No longer requires
      - Volume meshing step
      - Geometry preparation, including enforcing watertight condition
      - Continuous phase fluid models and solvers
      - Overset mesh for complex motion
  - Speed-up of DEM computations

        - On average 5x speedup for all applications with moving boundaries
    - Reduced time to solution due to improved stability and robustness of DEM simulations
    - Application examples in Heavy Equipment industry
        - Soil/rock excavation
        - Dump truck unloading
        - Agricutural machines and attachments
        - Mining and construction equipment

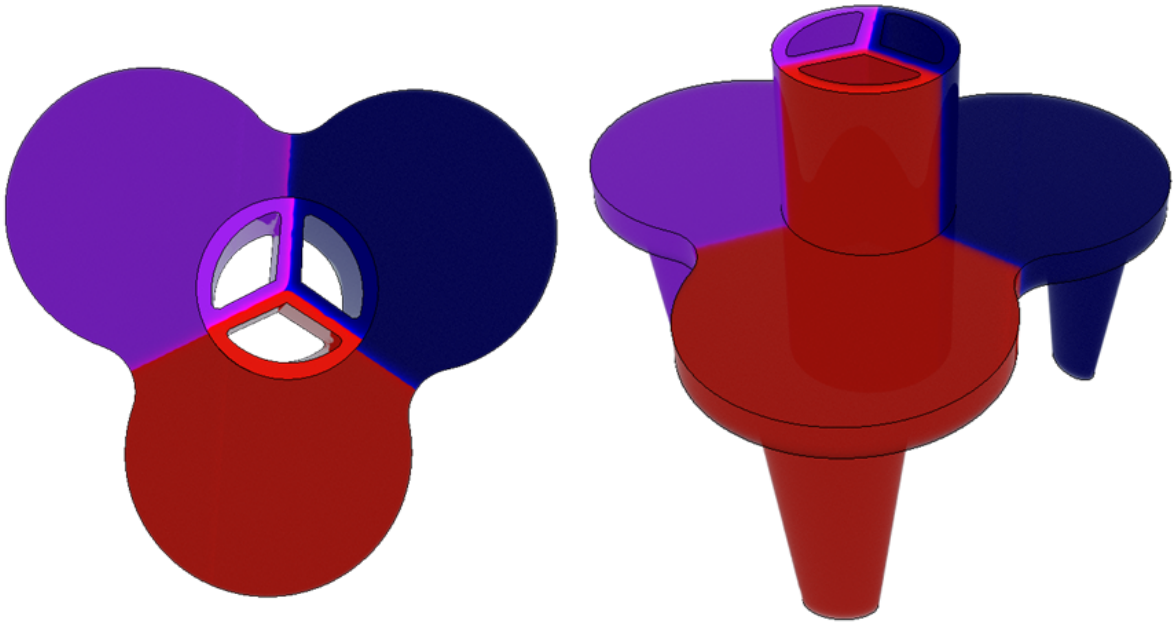
- **Flexible fibers D5039**
    - Improved speed and ease of use for all applications with flexible elongated particles through introduction of new Flexible Fiber model
        - Non-spherical fiber segments – cylinders
        - Optimal solution for bending and axial stiffness of fibers
        - Faster than using Particle Clumps
- **Repeatability of DEM simulations with Random Injector**
    - Helps in interpreting the results of parametric studies or DEM model calibration
- **Injector Orientation Specification option improved**
    - For setting initial orientation of DEM particles, you provide angles in the lab frame
    - No need for adjusting the orientation input to account for the difference between moment of inertia reference frame and lab frame

General Multiphase

- **Phase Mass Conservation Error Report D1728**
    - Increased accuracy by ensuring convergence by using a new report type Mass Conservation Error
    - Most useful for transient cases (but can also be used for steady state simulations)
        - Reports mass error for selected phases within a time-step or iteration
    - To monitor the cumulative mass error incured throughout a simulation, use a cumulative monitor of this report
        - Particularly useful in closed systems to identify systematic mass errors before they can accumulate
    - Can be used as the basis for stopping criteria to
        - Avoid uneccessary iterations to reduce computational cost for a given accuracy
        - Ensure convergence to improve accuracy for a given computational cost
    - Applicable to phases of VOF, MMP, EMP, Fluid Film, and DMP

Computational Rheology

- **Viscous Multiphase Solver D4011**
    - Predicts interaction of multiple viscous fluids
        - Model transient or steady state multiphase flow
        - Each phase may have a different rheological model including generalized Newtonian and viscoelastic models
        - Predicts phenomena such as encapsulation in co-extrusion
        - Provides alternative to morpher to find interface between fluids
        - Fluids can wrap around each other, separate, or undergo other topology changes that are impossible with the morpher due to fixed mesh topology



Computational Solid Mechanics

- **Eigenvalue analysis for normal modes D3687**
  - Gain structural performance insights by accessing vibration characteristics of structures with modal analysis
    - Extracts natural vibration mode shapes and frequencies of the structure
    - Allows determination of appropriate time-step to then model transient structural or fluid-structure interaction simulations
  - Reduced use of third-party tools thanks to inbuilt solution
    - Solid Stress Normal Modes optional model
    - Normal Modes accessible as Solution View
  - Support for linear models only: pre-stressing or pre-loading will not affect the model
- **FSI of Hyperelastic materials with contact: linearization of surface load**
  - Reduced time to solution with more efficient pressure linearization algorithm for highly nonlinear materials and applications
    - Relevant for applications with Hyperelastic materials (rubber), mechanical contact, large deformations, or strong fluid-structure coupling
- **Adaptive Time-Step Size - specify value for interval**
  - Enhanced solver controls for improved convergence with ability to specify time-step size on a given interval
- **Mechanical contact (frictionless, rigid obstacles): full linearization**
  - Reduced computational expense for contact simulations with curved, rigid obstacles
- **FSI Coupling Specification options renamed**
  - Easier set-up through clearer options in FSI Coupling Specification
    - Solid Deformation was renamed Solid Displacement, and None was renamed Uncoupled
- **Finite Volume Solid Stress is hidden in 2021.3**
  - Planned to be retired in 2022.1

Electromagnetics and Electrochemistry

Electromagnetics

- **Alpha-beta formulation for permanent magnets**
  - Simplification of setup of permanent magnets with temperature-dependent behavior thanks to introduction of alpha-beta formulation
    - Alpha-beta formulation is standard among manufacturers of magnets
    - Removed need to pre-compute or provide magnets' behavior via several B-H curves at different temperatures
- **Ampere-Turn method in Excitation Coil models split into different input conditions**
  - More intuitive setup of current-driven coils and busbars
- **Speedup of 2D simulations of e-machines**
  - Faster simulations and improved convergence in 2D thanks to revised algorithm
    - Current conservation is now enforced with an implicit method that allows for faster computations
    - Previously used explicit method was slow for simulations with high electrical conductivities
    - Range of speedups observed depending on the simulation

Case	Number of processors	Speedup
E-machine 1	1	9.6x
E-machine 2	1	33.2x
	2	26.5x
	8	34.2x
	32	37.8x
E-machine 3	1	7.1x
	5	8.9x
	32	7.9x

Electrochemistry

- **Electrochemical reactions with charged species**
  - Simplification of corrosion simulations thanks to charged species now able to participate in electrochemical reactions
    - Charged Species model now compatible with Electrochemistry Potential Reacting model
    - By using the Charged Species model, you can run simulations without having to necessarily impose Electrochemistry's dilute assumption (as required when Electrochemical Species model is utilized)
- **Implicit discretization of homogeneous electrochemical reactions in phasic porous media**
  - Improved robustness and reduced computational expense thanks to new implicit discretization
- **New warning message when default unit porosity is used with Electromagnetism model**
  - New message helps preventing wrong setups of phasic porous media
- **Expression support for under-relaxation factor of Electrochemistry Coupled Solver**
  - Improved flexibility for templating and design exploration studies with ability to use global parameters in expression definition

Aeroacoustics

- **Lighthill Wave model**
  - Enhanced ease of use and reduced opportunity for error with new hybrid aeroacoustics modeling approach, targeted at HVAC (Heating, Ventilation, Air Conditioning) systems
  - Simplifies the setup process, removes the need to define noise source regions compared to existing hybrid approach, the Acoustic Wave model
  - Reduced turnaround time with ability to use coarser meshes and fewer inner iterations yet retain accurate predictions compared to best practices with existing hybrid approach using the Acoustic Wave model
- **Ffowcs-Williams Hawkings (FW-H) data without .csv files**
  - Access FW-H results faster through an embedded workflow
  - No longer requires exporting and re-importing external .csv files as tables: access FW-H results natively, similarly to the monitor data
- **Standard Newmark (temporal scheme in Acoustic Wave solver) retirement in 2022.3**
  - Standard Newmark temporal scheme option of the Acoustic Wave solver has been deprecated starting in Simcenter STAR-CCM+ 2021.3 and is planned to be removed in 2022.3. The recommended practice is to use Newmark Alpha instead.

Motion, Mesh Adaption, and Mapping

- **Optimized interface performance for a large number of contacts**
  - Faster simulations for large number of contacts through automatic multithreading of topology-based interface intersection
    - Solver automatically switches on multithreading for improved concurrency based on number of contacts and available computing resources
      - Activated when the number of contacts is higher than available CPU sockets, for example:
        * Number of contacts = 20; Using 5 nodes with 2 sockets/node, available sockets = 10.
    - Applications: Engine crank case oil splash with several rotating components
    - No changes to user interface
- **Remeshing solver for dynamic fluid body interactions D2286**
  - Robust dynamic fluid body interaction (DFBI) morphing simulations through automatic remeshing
    - Upon encountering invalid mesh solver rolls back to the previous state and remeshes
    - Previously only explicit motions were supported
    - Now DFBI implicit motion cases are supported where body motion within inner iterations of a time-step may create an invalid mesh
      - If body motion within the first inner iteration of a time-step creates invalid mesh, then solver is rolled back to the beginning of time-step and remeshing is done
      - If body motion within a later inner iteration of a time-step creates invalid mesh, then solver is rolled back to the previous inner iteration, the 6-DOF solver is frozen to let other flow physics converge, and remeshing is done at the next time-step
    - Applications: Electric machines, marine sink, and trim
- **Remeshing solver for user-defined vertex motion**
  - Efficiently model remeshing for User-Defined Vertex Motion cases for predefined configurations
  - Applications: Vane pumps, piston cooling
- **Improved robustness for overset shell cases**

- Improved reliability of windscreen wiper simulations with overset shell regions through enhanced overset donor search
  - Helpful when the near-wall cell in the background region is much smaller than that in the overset region
  - Applications: Wiper water management where fluid-film is modeled via shell region and the background mesh has refinement zones to facilitate hybrid fluid-film to VOF transition, for example near A-pillar
- **DFBI multi-body: Six degree of freedom in body coordinate system**
  - Easily define motion for DFBI multi-bodies through six degree of freedom specification in body coordinate system
    - Previously a new coordinate system had to be defined and managed at the position of the body coordinate system
    - It is now possible to select the DFBI body's coordinate system to define the motion
- **DFBI multi-body: Redundant constraint detection**
  - Improved robustness of DFBI multi-body systems through automatic detection and removal of redundant constraints
    - Redundant equations arise due to various joints and constraints contributing to the same constraint equations
    - Redundant constraint detection option removes unnecessary constraint equations and makes the solution more robust
      - The default setting of "Tight" removes constraints that are close to redundancy
      - For intermittent redundancies, very large constraint deviations occuring through the course of the simulation can be resolved through "Relaxed" or "Loose" settings
    - Example: Automotive car door hinged by two revolute joints. Mathematically the second joint is not needed and will therefore be removed from the system

Design Exploration

Adjoint

- **Topology Optimization turbulence treatment - wall distance on interface**
  - Improved final design thanks to an improved optimization process
    - The wall distance is captured from the fluid-solid interface as opposed to the envelop boundaries
    - The PDE wall distance is used to calculate the wall distance from the material indicator
    - Physical quantities are calculated more accurately and a better correlation with the smoothed validation results is observed
    - Objectives are further optimized
- **Support for local coordinate systems in adjoint cost functions**
  - Improved usability of adjoint workflows thanks to support of the differentiation of vector and position field functions in local Cartesian, cylindrical, and spherical coordinate systems

Design Manager

- **Understand time-dependend trends for Design Manager studies through comparison of transient (monitor) data sources**

- Advanced Multiphysics simulation efforts are increasingly run to study time-dependent performance indicators, e.g.
  - Underhood vehicle thermal management
  - In-cylinder combustion
  - External aerodynamics
- Monitor data sources can now be stored and compared directly within Design Manager
  - Selectively store monitor as part of a Design Manager project
  - Comparative plots can use Design Sets to show
    - Specific designs, Baseline and/or Best Design (see image below)

- **Reuse compute resources configurations across multiple studies**
  - Set up your compute resources once and reuse the configuration for subsequent studies
  - Compute resources are now located in within Tools
- **Quicker Surrogate creation through new shortcut workflow**
  - Quicker, more consistent Design Manager surrogate study setup
- **Enhance knowledge extraction for surrogate modeling efforts in MS Excel with Visual Basic code export**
  - Gain further insight through compatible data exports to common engineering tools
- **Enable collaborative review of Design Studies outside of Simcenter STAR-CCM+ via extension of Tabulate and Export for all Design Manager plot types**
  - Expand the scope of quantitative interrogation for all Design Manager plots
- **Improve productivity through automated scrolling to target row(s) in Design Study tables**
  - Holding down the green left/right arrows enables continuous navigation through designs
    - In previous versions, the arrow keys needed to be repeatedly pressed to navigate designs

Data Analysis

- **Smaller .simh files through compression D3007, D3417**
  - Enhanced productivity through compressed .simh file export
    - Example: .simh file size reduction in 2021.3 for a transient model consisting of 17M cells exporting 26 field functions on 12 Parts in Inputs
      - Lossless: ~2x smaller
      - Lossy: Up to 8x smaller
      - Applicable to both native and non-native locations
    - Now store and share .simh files more efficiently
      - Compression mode option added under Expert property
      - Applicable to Surface data only
      - Options to export Lossless and Lossy compression
        * Lossless compression mode as default
        * Specify number of preserved digits under Lossy mode
- **Faster .simh setup and usage**
  - Quicker .simh data access through paired Solution Views creation
    - Automatic creation of Solution Views
      - Node named after .simh file

        - Corresponding representation added within Representations node
    - Improve productivity when working with .simh through Auto-Rescan
        - Reduced number of mouse clicks
        - Checkbox option to automatically sync all states in file
            * Default option is active on .simh creation
        - No need to manually rescan data on .simh export

- **Automatic recording of Motions in .simh file D1383, D4164, D5570**
    - Efficiently create Motion animations within a Scene through recorded Motion data in .simh
        - Generate ~10x smaller .simh file compared to previous releases
        - Automatic export of all defined Motions to .simh file
        - Recorded Representation option added under Motion Transform
        - Control specification of the Motion being recorded
- **More adaptable File-based coupling using .simh**
    - Effectively collaborate with other analysis tools through the integration of Simcenter STAR-CCM+ .simh and Data Set Functions
        - Map .simh data onto imported CAE model and export in .mat file
        - Target Surfaces allows selection of surfaces from imported CAE model
            - Removes previous limitation of both surfaces to be from chosen representation

- **Circumferentially averaged profile plot D3418**
    - Faster comprehension of flow solution data for design analysis using Average Profile part
        - Simplified plotting of circumferentially averaged flow compared to previous releases
        - Automatic plotting of raw and averaged data on same axis
        - Removes the need for writing custom field functions
        - Improved performance compared to legacy field function method
            - Faster computation
            - Reduced memory usage
    - Flexible binning strategies
        - Able to automatically resolve underlying mesh
        - Optional setting to set a number of constant size bins
- **Whole e-machine report with Idealizations**
    - Easily gain insight in to whole e-machine performance with only a sector model solution using Idealizations
        - Automatically converts from sector to whole e-machine quantities for Magnetic Force and Magnetic Torque reports
            - Checkbox option to enable Idealization added to properties panel
            - Compatible with periodic interfaces only
        - Eliminates the need for dozens of mouse clicks, extra reports, and manual bookkeeping

- **Expanded quantitative transient data analysis D922, D5200**
    - Quickly gather insights on variability in simulation data of interest
        - Use Variance of outlet Temperature monitor to deduce uniformity
        - Use Root Mean Square of pressure to assess combustion stability
    - Easily compute Root Mean Square of a Field Function for selected Parts
        - Trigger types include
            - Iteration, Time Step, Delta Time, Update Event

        - Support for Sliding Sample
        - Avoid writing complicated macros

- **Easier customization of Plot Colors D1234, D3251**
    - Easily compare residual plots between simulations through consistent plot colors assignment
        - Set and maintain colors tied to specific Inputs
            - Avoid different colors being used for data series due to model selection
            - Specify Color Assignment policy
            - Copy and paste palettes between different simulations
    - Default sequence of data series colors under 'All Inputs'
        - New plot default color palette set to Siemens color
- **Enhanced Line and Symbol rendering in Plots**
    - Improved out of the box readability of Plots through updated default setup
        - Allows for easier identification of datasets
        - New Plots and Plotted Objects use increased Line and Symbol Style sizes
            - Restored plots use existing Style sizes
            - Applies to both Simulation and Design Manager projects
- **Improved rendering of thick Lines in Plots**
    - Achieve improved visual comprehension of Plots with thick Lines
        - Avoid misinterpretation of data
        - Smoother appearance of thick Lines using updated framework
            - Removes gaps at sharp angles
            - Avoids overlap of consecutive line segments
        - Complies with requirements of WebGL

- **Axisymmetric parameterization expanded geometry coverage D3418**
    - Allows flow path parameterization of turbomachinery geometries containing additional geometric features
        - Full machine 360° models
        - Multiple leakage channels on the hub and/or shroud
        - Endwall contouring
    - Compatible with other features that rely on axisymmetric parameterization
        - Profile average
        - Surface average
        - Conformal and isometric embedding
- **Planar embedding view reset**
    - Simplifies visualization workflow and eliminates the need for manually determining appropriate view
        - Automatically positions the scene view to the appropriate location when conformal or isometric embedding transformations are applied
        - View is reset when all embedding transformations are removed

- **Visually interpret report output in a Scene D3116**
    - Easily locate Center of Loads through Visual Annotation
        - Communicate critical results to stakeholders for faster decision-making
        - Robust workflow encapsulates qualitative presentation of complex calculation
        - Ability to drag-and-drop annotation in Scene

- Generate geometry aware annotation automatically
  - Location of Center of Loads shown as a sphere
  - Direction of Force vector shown as 3D glyph
  - Customizable annotation display options

- **Faster Plane Sections creation and display D4428**
  - Assess flow features for faster decision making using downsampled data
    - Interactively reveal complex flow phenomena on large datasets
  - Resampled Volume is used for downsampling
    - New Plane Section Rendering mode enabled under Resampled Volume Settings
    - Customize up to three Plane Sections
    - Modify Plane Sections interactively in-scene
    - Screenplay support for animation
    - Qualitative assessment only
  - Recommendation: Use GPU/OpenGL rendering only
- **Efficient Resampled Volume refinement strategy**
  - Generate smaller Resampled Volumes out of the box through Diagonal Refinement Metric
    - Reduced rate of Voxel Count rise with increasing Cell-to-Voxel Ratio
    - User selectable Refinement Metric options
      - Surface method used in previous releases
      - Diagonal method set as new default
        * Less aggressive refinement of prism layers

- **Pragmatic file size reduction for Scene files D2413, D5527**
  - Enhanced productivity through reduced level of detail for Scene file export
    - Smaller Scene file requires less disk space
    - Requires less rendering resources
    - Easier to share with collaborators
  - Lossy Compression mode option added
    - Applicable to Surface and Resampled Volume data
- **Enhanced photo-realistic rendering using Clearcoat**
  - Create realistic rendering of materials through Clearcoat
    - Allows for more realistic depiction of paint surfaces
  - Specify 'Clearcoat IOR' value for simulating glossiness
    - Applicable to Matte and Metallic materials
    - Value ranges between 1 and infinity

- **Harmonized hardcopying and export setup for Scenes and Plots D3251**
  - Increased ease of setup for hardcopying and exporting of Plots
    - Consistency with Scenes hardcopying workflow
    - Antialiasing and Transparent Background options added to
      - Plot export and hardcopy dialog
      - Export Simulation Operation node
    - Hardcopy Antialiasing property removed from Plot nodes
    - Antialiasing property removed from Tools>Options>Plotting
  - Improved readability of Plot Image annotation in Scenes

        - Control Opacity of Plot Image annotation
            - Default Opacity value of 1

Application Specific Tools

Contents:

In-cylinder Solution

- **Complex Chemistry combustion model**
    - Accurate ignition and emission prediction through Complex Chemistry combustion model
        - Fast and straightforward setup of all species, reactions, thermodynamics, and transport properties through CHEMKIN (TM) format files import
    - Accurate flame position in turbulent-drived flames through Turbulent Flame Closure
    - Shorter turnaround times using Relax to Chemical Equilibrium in cases where knock or emissions are less important
- **Real Gas model**
    - Higher accuracy for high cylinder pressures through real gas equation of state
    - Redlich-Kwong model is activated by default, other models can be selected in the Simulation tree
- **Soot Sectional Method model**
    - Improved prediction of total soot mass and particle size distribution through soot sectional method
    - Includes nucleartion, condensation, surface growth, and coagulation stages of soot formation, as well as soot oxidation
    - Compatible with ECFM-3Z, ECFM-CLEH, and Complex Chemistry combustion models
- **Support for carbon-free fuels**
    - Support for any CHON formulation of fuel (including pure hydrogen and ammonia) in the ECFM-3Z and ECFM-CLEH combustion models
        - Hydrogen and ammonia included in the ECFM fuels database
    - Complex chemistry combustion model with Turbulent Flame Closure option, previously compatible with hydrogen as a fuel, is also now compatible with ammonia
- **Multiple injectors can now be defined in a single model**
- **PISO solver selected by default**
    - Inlet/outlet extrusion layers also activated by default, as recommended when using the PISO algorithm
- **Cyclic time printed to the output window during the simulation**
- **"Injector Mass Injected" plot renamed to "Fuel Mass Tracking"**
    - Better representation of what is displayed in the plot, including fuel that is initialized/convected into the model
- **Improved performance through single shell region specified for liquid film model setup**
- **Option to select for which walls the liquid film model will create shells**

- Previously, all walls were assumed to be relevant for modeling liquid film
- Allowing direct specification of which walls to include in the model improves performance

- **"Keep Feature Edges" input when creating parts**
  - Allows selective retention of edges, which can result in better meshes with fewer unimportant CAD feature lines preserved
    - Named edges are always preserved

Electronics Cooling

- To aid stability, the default under-relaxation factors for both segregated solid and fluid energy has been changed to 0.9999 and 0.99 respectively

Batteries

- **New Improved Simcenter STAR-CCM+ Batteries workflow**
  - New workflow with significant improvements from the original Simcenter Battery Design Studio-dependent workflow
  - Operating without a Simcenter Battery Design Studio (BDS) input file
    - The input TBM file is no longer required
    - The entire process is fully contained in Simcenter STAR-CCM+ so you do not have to change environments between tasks
  - Leveraging a new RCR 0D model
    - Much faster to compute, up to 10X speed-up compared to the original workflow
    - Significantly lower memory consumption with good scalability, allowing to run thousands of battery cells
    - Significantly higher accuracy than the typical uniform, constant heat source term applied to a cell.
    - Dedicated relevant outputs are provided, including voltage, heat generation, state of charge, and current density
  - Simplified setup for improved usability and productivity
    - RCR 0D model configuration now available in the Simcenter STAR-CCM+ Batteries node, with two new configuration options
      - Direct import of RCR data to the look-up tables
        * Useful if the model fitting was performed on a 3rd party tool
        * Respect of name convention in the header helps populating the look-up tables automatically
      - Fully automated setup via RCR data extraction from a TBM file
        * Useful if the model fitting was previously performed in Simcenter Battery Design Studio
  - Supports arbitrary, user designed cells geometries
    - Support for import of battery cell geometry gives more flexibility on the cell's shapes
    - Simplified interfacing with the rest of the battery packs geometry parts
    - Lets you decide how the RCR performance model is assigned to the cell's parts
  - Fast and flexible battery cell model assignment to geometry parts
    - Dedicated user interface for easy configuration and assignment with two options:
      - A bulk manual assignment, the selected cell's parts are associated to the selected cell's objects in their appearance order
      - Using a mapping technique leveraging the parallel and series indexes in the parts names.

- To access this new workflow, a "Simcenter STAR-CCM+ Batteries add-on" license is required
- Legacy workflow continues to be supported

E-Machines

- **Enhanced E-Machines Performance Workflow**
  - Easier workflow through direct import of e-machine design files from Simcenter SPEED
    - E-machine design geometry is automatically generated in 3D-CAD and exported to Parts
    - E-machine materials data are imported into the parts metadata field
    - A template sim file can be used to setup automatically the full model including the physics

User Guide

- **New Tutorials**
  - Compressible Flow
    - Anisotropic Volume Meshing: Onera M6 Wing
  - Multiphase Flow
    - Mixture Multiphase with Large Scale Interfaces: Gear Lubrication
  - Discrete Element Method
    - Meshfree DEM: Excavator
  - Solid Stress
    - Normal Modes Solver: Wind Turbine Blade
  - Battery
    - Electro-Thermal Modeling: Battery Pack Cooling
- **Modified Tutorials**
  - Gas Turbine Aerodynamics: Post-Processing – added topic for creating a profile average plot
  - Hybrid Multiphase: Fountain – added VOF-Lagrangian transition criteria
  - Hyperelastic Stress Analysis with Adaptive Time-Step: Trileaflet Heart Valve – linearized the pressure boundary condition
  - Ffowcs Williams-Hawkings: Sound Propagation – updated to use the new FW-H receiver table workflow
  - Several other tutorials were updated to conform to the latest user interface and default settings in their respective areas.

Important Notes 2021.3

This section contains important notes that you must become familiar with before using this latest release of Simcenter STAR-CCM+. If you have questions about any of these important notes, please contact your Simcenter customer support representative.

Java Upgraded to OpenJDK Version 11.0.10

The Java SDK (Software Development Kit), which is required to compile Java macros, has been upgraded to OpenJDK v11.0.10 in the current release. Simcenter STAR-CCM+ ships with AdoptOpenJDK 11.0.10+9. JDK builds prior to 11.0.10+9 do not work, but later versions of JDK 11 are allowed (both OpenJDK-based distributions and Oracle's JDK).

Changes to Deployment

- **Newly certified operating systems (OS)**
  - RHEL 7.9, Amazon Linux 2, HPE Cray OS (supported)
- **Retired operating systems (OS)**
  - CentOS 7.4
- **Scheduled operating systems (OS) for Simcenter STAR-CCM+ 2022.1**
  - Adding: RHEL/Rocky 8.4, OpenSUSE Leap 15.3 SLES 15 SP3, Cloud Linux 8
  - Adding: Windows 10 21H1, 21H2
  - Retiring: CentOS/RHEL 7.7, 8.0, 8.1, CentOS 8.2, openSUSE Leap 15, 15.1, SLES 12 SP3, SP4, 15, 15 SP1
  - Retiring: Windows 10 1903, 1909, 20H1, Server 2012
- **Newly certified Message Passing Interface (MPI) versions**
  - None to add in this release
- **Retired Message Passing Interface (MPI) versions**
  - Platform MPI - this MPI is no longer distributed or supported starting with Simcenter STAR-CCM+ 2021.3. If you are still using Platform MPI
    - on Linux: please move to Open MPI (preferred) or Intel MPI,
    - on Windows: please move to MS-MPI (for single-workstation or Windows HPC Cluster simulations) or Intel MPI (for multi-workstation simulations).

    Consult the documentation for further information.
- **Scheduled Message Passing Interface (MPI) versions for Simcenter STAR-CCM+ 2022.1**
  - Adding: Intel 2021.2 (Windows)
  - Retiring: Intel MPI 2019.7 (LINUX)

Flexlm: Version 11.18.0.0 Required for 2021.3

Version 11.18.0.0 of the license server that is supplied with Simcenter STAR-CCM+, Flexlm, is now required to run the current version of Simcenter STAR-CCM+.

Libfabric: Upgrade to Version 1.12.0

Libfabric 1.12.0 is now distributed with the current release. Libfabric 1.9.0 and older versions are no longer supported for running Simcenter STAR-CCM+.

Profiles and Expressions: Change to Recommended Interpolation Option

The **Cubic (Akima)** interpolation method is now available for the *Interpolation* property of applicable tabular profiles, as well as for expressions. It is the new recommended option.

Simulation Assistant: End of Simulation Assistant Wizard

The Simulation Assistant Wizard (`NetBeansWizard.nbm`) has been removed.

Meshing

Planned Removal of Region-Based Meshing (2022.1)

Region-based meshing is planned to be removed from Simcenter STAR-CCM+ in version 2022.1.

After the change, when you restore a file using region-based meshing, the following will happen: All volume meshes that were generated by region-based meshing will be preserved and will be treated as if the volume mesh was imported into Simcenter STAR-CCM+. You will be able to adjust physics settings and re-run simulations with the old volume meshes. However you will not be able to change mesh settings or remesh without creating parts-based mesh operations.

The recommended practice is to use parts-based meshing—see the section "Simcenter STAR-CCM+ > Pre-Processing > Meshing > Parts-Based Meshing" in the Simcenter STAR-CCM+ User Guide.

Planned End of Serial Prism Subsurfacer Environment Variable (2022.1)

The serial prism subsurfacer environment variable allows the prism subsurfacer to be created in serial rather than in parallel. This environment variable has been deprecated starting in Simcenter STAR-CCM+ 2021.1 and is planned to be removed in 2022.1.

Motion: Change to Default Motion for Inactive Physics Continua

Motion is now deactivated by default for inactive physics continua. Prior to the current release, it was activated.

However, you can activate motion on an inactive physics continuum by turning on the new *Motion Always Active* property of that continuum.

Heat Transfer: Changes to Radiation Workflow

The radiation workflow for external boundaries has been simplified, changing the use of objects as follows:

- The **Surface Orientation Option**, which was used to activate radiation from the external side of the boundaries, is no longer available in the current release. Instead, set the **Radiation Transfer Option** region condition to **External**.
- The **Environment** thermal specification option is no longer available in the current release. To get the same thermal behavior for the boundary, choose **Convection**.
- The **Environment** thermal specification option was also used to activate external radiation on boundaries in the presence of thermal radiation. Instead, set the **Radiation Transfer Option** region condition to **External** or **Internal and External**, whichever is appropriate for your simulation.

Turbulence: Planned Deprecation of High-Reynolds Number Spalart-Allmaras Model

The High-Reynolds Number Spalart-Allmaras turbulence model is planned for deprecation in a future release.

Aeroacoustics

Data from On-the-Fly FW-H Receiver and Post FW-H Receiver No Longer Requires .csv Export

For On-the-Fly FWH and Post FWH solvers, the computed acoustic data now remains stored in the FW-H Receiver node. Table objects that contain this data now exist under each receiver node, and are ready for post-processing just like any other internal tables. As a result, the following right-click actions for the On-the-Fly FWH Receiver have been removed:

- **Export Surface Total**
- **Export Surface Thickness**
- **Export Surface Loading**
- **Export Volume Quadrupole**

For the Post FW-H Receiver, the **Export** action has been removed.

Planned End of Convective Option in Ffowcs Williams-Hawkings (FW-H) Modeling

The Convective Acoustic Effects option in FW-H modeling has been deprecated starting in Simcenter STAR-CCM+ 2020.2 and is planned for removal from a future version.

Deprecation of Standard Newmark Solver Setting

The Standard Newmark option has been deprecated starting in Simcenter STAR-CCM+ 2021.3 and is planned to be removed in 2022.3. The recommended practice is to use Newmark Alpha. See the section "Acoustic Wave Model Reference" in the Simcenter STAR-CCM+ User Guide.

Lagrangian Multiphase: Change to Orientation of Injected Particles

Due to an adjustment in the orientation of particle injection, the selection of the **Angles, Body Aligned** method for the **Orientation Specification** injector condition may now produce a different orientation for the injection of a polyhedral particle.

End of Finite Volume Solid Stress

Finite Volume Solid Stress was deprecated starting in Simcenter STAR-CCM+ 2021.1 and has been removed.

Electromagnetism: Changes to AMG Solver Handling of Current Conservation

The **Current Conservation Option** region condition is now treated implicitly as an additional degree of freedom by the AMG solver. To improve convergence, the following changes are recommended to the solver properties:

- *Acceleration Method*: **Bi-Conjugate Gradient Stabilized**
- *Convergence Tolerance*: `1.0E-5` (default: `0.05`)
- *Max Cycles*: `200` (default: `30`)

Visualization: Changes to Scalar Displayer Volume Rendering User Interface

In addition to the introduction of plane sections as a volume rendering mode, the following changes have been made to the **Volume Rendering Settings** sub-node of the scalar displayer:

- The **Volume Rendering Settings** sub-node has been renamed **Resampled Volume Settings**.
- In the *Rendering Mode* property of this sub-node, the **Direct** option has been renamed to **Volume**, and the **Level Surface** option has been renamed to **Isosurface**.

- The *Lighting Mode* property is now set by default to **Automatic**. Therefore lighting effects are deactivated by default for **Volume** and **Maximum Opacity Projection** rendering modes, and are activated by default for **Isosurface** and **Plane Section** rendering modes.

For backwards compatibility, these changes have no effect on macros recorded in previous versions of Simcenter STAR-CCM+.

Solution Histories: Automation of Solution View Creation and Solution History Rescan

When a new property of the solution history node, *Auto-Rescan*, is activated (by default for simulation histories created in the current version), two actions take place:

- A solution view is created for a solution history file once the export to the simulation history file is finished. Within **Solution Views**, Simcenter STAR-CCM+ adds a node named after the solution history. Simcenter STAR-CCM+ also adds a corresponding representation within the **Representations** node.
- A rescan operation is automatically performed. This operation ensures that data in the file is synchronized with data in memory, making all states in the solution history readily available for viewing.

This option is deactivated for solution histories created before the current version.

Plots: Changes to Default Appearance of New Plots

With the introduction of a new color management system for plots in Simcenter STAR-CCM+, along with improved rendering techniques, new sets of default colors, line widths, and symbol sizes appear in new plots and data sets.

Previously created plots restore to their existing style sizes. New plots created from restored simulations and design projects use the new defaults. Bubble plot defaults remain unchanged.

For Design Manager, plotted objects for special cases were unified. Based on the new standard defaults, emphasized components received a uniform increase in size.

Changes to default line widths and symbol sizes are listed in the following tables.

General (for both Simulations and Design Projects)		
Property	**Previous Release**	**Current Release**
Line Style Size, Standard	1.0	3.0
Line Style Size, Histograms	1.0	1.5
Line Style Size, Parallel Plots	1.0	1.5
Symbol Style Size (Overall Size)	6.0	12.0
Symbol Style Width (Stroke Thickness)	1.0	2.0

Specific to Design Manager		
Property	**Previous Release**	**Current Release**
Response Constraint Bounds: Line Style Size	1.0	2.0
Best Design: Line Style Size, Standard	2.0	5.0
Best Design: Symbol Style Size, Standard	15.0	18.0
Best Design: Symbol Style Width, Standard	3.0	3.0
Best Design: Line Style Size, Parallel Plots	3.0	3.5

Specific to Design Manager		
Property	**Previous Release**	**Current Release**
Best Design History: Line Style Size, Standard	3.0	5.0
Baseline Design: Line Style Size, Standard	2.0	5.0
Baseline Design: Symbol Style Size, Standard	15.0	18.0
Baseline Design: Symbol Style Width, Standard	3.0	3.0
Baseline Design: Line Style Size, Parallel Plots	3.0	3.5
Pareto Ranks: Symbol Sizes by Rank	(6, 14, 22, 30)	(12, 18, 24, 30)
Pareto Ranks: Symbol Width	2.0	3.0

Data Set Functions: Removal of Surface Time History Data Set Function Limitation

In data set functions of previous releases, the *Target Surfaces* property of the **Multi-Point Time History** sub-node of the surface time history was restricted to the same representation as the *Data Surfaces 1* property.

In the current release, this restriction has been removed, allowing the *Target Surfaces* property to access surfaces from an imported CAE model, which may be separate from the selected representation.

Macro API Changes 2021.3

This section contains the changes to the macro API since the previous release of Simcenter STAR-CCM+.

3D-CAD

Changes to Handling of Feature Failures

In the current release, when a **Unite Bodies** or **Subtract Bodies** feature fails, the bodies, faces, edges, and vertices that are responsible for the failure are highlighted whenever you select the corresponding node of the failed feature. This new feature has resulted in changes to the macro code. Deprecated components have been replaced as follows:

- `UniteBodiesFeature createUniteBodies(List<Body> bodies);` has been replaced by `UniteBodiesFeature createUniteBodies_2(List<Body> bodies);`.
- `UniteBodiesFeature createUniteBodies();` has been replaced by `UniteBodiesFeature createUniteBodies_2();`.

Changes to Imprint Option

The two imprinting features of 3D-CAD, for imprinting bodies onto bodies and faces onto faces, have been enhanced. They now allow you to specify whether the target bodies/faces should be imprinted onto the tool bodies/faces, rather than this imprint happening automatically. These specifications are available only for body-imprinting features for which the **Imprint Option** is set to **Between two Groups of Bodies**, and for face-imprinting features for which the **Imprint Option** is set to **Between Faces of two Bodies**.

The new public member functions `Imprint::setImprintOntoToolBodies` and `ImprintFaces::setImprintOntoToolFaces` are used for controlling this imprint, as shown in the following examples:

```
Imprint imprintBodies = cadModel.getFeatureManager().createImprint();
imprintBodies.setImprintOntoToolBodies(false);
```

```
ImprintFaces imprintFaces = cadModel.getFeatureManager().createImprintFaces();
imprintFaces.setImprintOntoToolFaces(false);
```

These settings can be queried with the new public member functions `Imprint::isImprintOntoToolBodies` and `ImprintFaces::isImprintOntoToolFaces`.

Meshing: Changes Due to New Surface Mesh Numbering

The process of splitting part surfaces and part curves has changed, so that the numbering of the new parts is consistent and independent of factors such as CAD tessellation. While this change does not affect simulation files saved in previous versions, it does produce numbering that is different from that of the previous release.

Therefore if you have macros that depend on this numbering, update those macros as shown in the following table. For example, the part surface that in the previous release was named `Block Surface 4` is now named `Block Surface`, that is, the name of the surface before splitting. Hence the variable `partSurface_1` is no longer needed.

Previous Release	Current Release
`Simulation simulation_0 = getActiveSimulation(); SimpleBlockPart simpleBlockPart_0 = ((SimpleBlockPart) simulation_0.get(SimulationPartManager.class).getPart("Block")); PartSurface partSurface_0 = ((PartSurface) simpleBlockPart_0.getPartSurfaceManager().getPartSurface("Block Surface")); simpleBlockPart_0.getPartSurfaceManager().splitPartSurfacesByAngle(new NeoObjectVector(new Object[] {partSurface_0}), 89.0); AutoMeshOperation autoMeshOperation_0 = ((AutoMeshOperation) simulation_0.get(MeshOperationManager.class).getObject("Automated Mesh")); SurfaceCustomMeshControl surfaceCustomMeshControl_0 = ((SurfaceCustomMeshControl) autoMeshOperation_0.getCustomMeshControls().getObject("Surface Control")); surfaceCustomMeshControl_0.getGeometryObjects().setQuery(null); PartSurface partSurface_1 = ((PartSurface) simpleBlockPart_0.getPartSurfaceManager().getPartSurface("Block Surface 4")); surfaceCustomMeshControl_0.getGeometryObjects().setObjects(partSurface_1);`	`Simulation simulation_0 = getActiveSimulation(); SimpleBlockPart simpleBlockPart_0 = ((SimpleBlockPart) simulation_0.get(SimulationPartManager.class).getPart("Block")); PartSurface partSurface_0 = ((PartSurface) simpleBlockPart_0.getPartSurfaceManager().getPartSurface("Block Surface")); simpleBlockPart_0.getPartSurfaceManager().splitPartSurfacesByAngle(new NeoObjectVector(new Object[] {partSurface_0}), 89.0); AutoMeshOperation autoMeshOperation_0 = ((AutoMeshOperation) simulation_0.get(MeshOperationManager.class).getObject("Automated Mesh")); SurfaceCustomMeshControl surfaceCustomMeshControl_0 = ((SurfaceCustomMeshControl) autoMeshOperation_0.getCustomMeshControls().getObject("Surface Control")); surfaceCustomMeshControl_0.getGeometryObjects().setQuery(null); surfaceCustomMeshControl_0.getGeometryObjects().setObjects(partSurface_0);`

Heat Transfer: Changes to Radiation Workflow

Due to the simplified radiation workflow for external boundaries, macro code has changed.

The **Surface Orientation Option**, which was used to activate radiation from the external side of the boundaries, is no longer available in the current release. Instead, set the **Radiation Transfer Option** region condition to `EXTERNAL`, as shown in the examples:

Previous Release	Current Release
`region_0.getConditions().get(SurfaceOrientationOption.class).setSelected(SurfaceOrientationOption.Type.OUTWARD);`	`region_0.getConditions().get(RadiationTransferOption.class).setSelected(RadiationTransferOption.Type.EXTERNAL);`

The `ENVIRONMENT` thermal specification option is no longer available in the current release. To get the same thermal behavior, choose the `CONVECTION` thermal option:

Previous Release	Current Release
`boundary_0.getConditions().get(WallThermalOption.class).setSelected(WallThermalOption.Type.ENVIRONMENT);`	`boundary_0.getConditions().get(WallThermalOption.class).setSelected(WallThermalOption.Type.CONVECTION );`

When thermal radiation was used in the previous release, the `ENVIRONMENT` thermal specification also automatically activated external radiation from a boundary. In the current release, you must set the **Radiation Transfer Option** to **External** or **Internal and External** as appropriate, via the following macros:

```
region_0.getConditions().get(RadiationTransferOption.class).setSelected(RadiationTransferOption.Type.EXTERNAL);

region_0.getConditions().get(RadiationTransferOption.class).setSelected(RadiationTransferOption.Type.DUAL_SIDED);
```

Aeroacoustics: Data from On-the-Fly FW-H Receiver and Post FW-H Receiver No Longer Requires .csv Export

For On-the-Fly FW-H and Post FW-H solvers, the computed acoustic data now remains stored in the FW-H Receiver node. Table objects that contain this data now exist under each receiver node, and are ready for post-processing just like any other internal tables. As a result, the following right-click actions for the point receiver have been removed:

- **Export Surface Total**
- **Export Surface Thickness**
- **Export Surface Loading**
- **Export Volume Quadrupole**

This redesign has resulted in changes to the macro code. For the Post FW-H Receiver, remove the following line that represented the **Export** action:

```
pointFwhPostProcessingReceiver_0.exportTotalTrn(f1.getAbsolutePath());
```

and add the following lines:

```
ReceiverTable receiverTable_0 =
pointFwhPostProcessingReceiver_0.getReceiverTable();
receiverTable_0.export(f1.getAbsolutePath());
```

For the On-the-Fly FW-H Receiver, to update macro code for the removal of the various export actions, replace the lines from the previous release with the lines from the current release as shown in the following table:

Previous Release	Current Release

`pointReceiver_0.export(f.getAbsolutePath());`	`ReceiverTable receiverTable_0 =`
	`pointReceiver_0.getReceiverTable();`
	`receiverTable_0.export(f.getAbsolutePath());`

`pointReceiver_0.exportLoading(fLoading.getAbsolutePath());`	`XYPlot xYPlot_1 =`
	`simulation_0.getPlotManager().createPlot(XYPlot.class);`
	`xYPlot_1.getDataSetManager().addDataP`

Previous Release	Current Release

	roviders(new NeoObjectVector(new Object[] {receiverTable_0}));
	ExternalDataSet externalDataSet_1 = ((ExternalDataSet) +xYPlot_1.getDataSetManager().getDataSet("PointReceiver1"));
	externalDataSet_1.setXValuesName("Acoustic Time");
	externalDataSet_1.setYValuesName("Sound Pressure Loading Noise");
	xYPlot_1.getDataSetManager().writeCSVDataSet(externalDataSet_1, fLoading, ",",);

pointReceiver_0.exportThickness(fThickness.getAbsolutePath());	XYPlot xYPlot_2 = simulation_0.getPlotManager().createPlot(XYPlot.class);
	xYPlot_2.getDataSetManager().addDataProviders(new NeoObjectVector(new Object[] {receiverTable_0}));
	ExternalDataSet externalDataSet_2 = ((ExternalDataSet) +xYPlot_2.getDataSetManager().getDataSet("PointReceiver1"));
	externalDataSet_2.setXValuesName("Acoustic Time");
	externalDataSet_2.setYValuesName("Sound Pressure Thickness Noise");
	xYPlot_2.getDataSetManager().writeCSVDataSet(externalDataSet_2, fThickness, ",",);

pointReceiver_0.exportQuadrupole(fQuadrupoleSoundPressure.getAbsolutePath());	XYPlot xYPlot_2 = getSimulation().getPlotManager().createPlot(XYPlot.class);
	xYPlot_2.getDataSetManager().addDataProviders(new NeoObjectVector(new Object[] {receiverTable_0}));
	ExternalDataSet externalDataSet_0 = ((ExternalDataSet) +xYPlot_2.getDataSetManager().getDataSet("PointReceiver1"));
	externalDataSet_0.setXValuesName("Quadrupole Acoustic Time");
	externalDataSet_0.setYValuesName("Quadrupole Sound Pressure");
	xYPlot_2.getDataSetManager().writeCSVDataSet(externalDataSet_0, fQuadrupoleSoundPressure, ",",);

Reacting Flow: Changes to Flamelet Models

Interpolation of variables from the flamelet table has been optimized for faster performance, resulting in changes to the macro code. Components have been replaced as follows:

- `physicsContinuum_0.enable(PpdfIdealGasModel.class);` has been replaced by `physicsContinuum_0.enable(PpdfEquilibriumIdealGasModel.class);`

- `continuum.enable(IdealGasWithFlameletModel.class);` has been replaced by `continuum.enable(PpdfFlameletIdealGasModel.class);`
- `gasMixture_0.getMaterialProperties().getMaterialProperty(SpecificHeatProperty.class).setMethod(PpdfFlameletSpecificHeatMethod.class);` has been replaced by `gasMixture_0.getMaterialProperties().getMaterialProperty(SpecificHeatProperty.class).setMethod(PpdfOneHlrSpecificHeatMethod.class);`
- `gasMixture_0.getMaterialProperties().getMaterialProperty(SpecificHeatProperty.class).setMethod(PvmSpecificHeatMethod.class);` has been replaced by `gasMixture_0.getMaterialProperties().getMaterialProperty(SpecificHeatProperty.class).setMethod(FgmOneHlrSpecificHeatMethod.class);`

Eulerian Multiphase (EMP)

Extension of EMP CFL-Based Time-Step Control

The **Convective CFL Condition**, a time-step provider in EMP, is now substituted and enhanced by the **Smoothed Convective CFL Condition**, resulting in changes to the macro code.

Previous Release

```
Simulation simulation_0 =
getActiveSimulation();
PhysicsContinuum physicsContinuum_0
= ((PhysicsContinuum)
simulation_0.getContinuumManager().
getContinuum("Physics 1"));
AdaptiveTimeStepModel
adaptiveTimeStepModel_0 =
physicsContinuum_0.getModelManager().
getModel(AdaptiveTimeStepModel.class)
;
ConvectiveCflTimeStepProvider
convectiveCflTimeStepProvider_0 =
adaptiveTimeStepModel_0.getTimeStepPr
oviderManager().
createObject(ConvectiveCflTimeStepPro
vider.class);


convectiveCflTimeStepProvider_0.getTa
rgetMaxCfl().setValue(10.0);
Units units_0 = ((Units)
simulation_0.getUnitsManager().getObj
ect(""));
convectiveCflTimeStepProvider_0.getTa
rgetMaxCfl().setUnits(units_0);

//"Target Mean CFL Number" does not
exist in future releases
Units units_0 = ((Units)
simulation_0.getUnitsManager().getObj
ect(""));
convectiveCflTimeStepProvider_0.getTa
rgetMeanCfl().setUnits(units_0);
```

Current Release

```
Simulation simulation_0 =
getActiveSimulation();
PhysicsContinuum physicsContinuum_0
= ((PhysicsContinuum)
simulation_0.getContinuumManager().ge
tContinuum("Physics 1"));
AdaptiveTimeStepModel
adaptiveTimeStepModel_0 =
physicsContinuum_0.getModelManager().
getModel(AdaptiveTimeStepModel.class)
;
EmpSmoothedConvectiveCflTimeStepProvi
der
empSmoothedConvectiveCflTimeStepProvi
der_0 =
adaptiveTimeStepModel_0.getTimeStepPr
oviderManager().createObject(EmpSmoot
hedConvectiveCflTimeStepProvider.clas
s);

empSmoothedConvectiveCflTimeStepProvi
der_0.getMaxConditionLimit().setValu
e(10.0);
Units units_0 = ((Units)
simulation_0.getUnitsManager().getObj
ect(""));
empSmoothedConvectiveCflTimeStepProvi
der_0.getMaxConditionLimit().setUnit
s(units_0);
```

Change to Liquid Film Stripping

Improvement of liquid film stripping has resulted in changes to the macro code. To update your macros, remove instances of code shown in the following example:

```
filmStrippingEMPModel_0.getStrippingVolumeFractionLimit().setValue(0.8);
```

Dispersed Multiphase: Changes to Particle Size Specification

Beginning with the current release, the particle size information for DMP phases is no longer specified as a material property, but as an interaction length scale in each phase interaction. Update your macros as shown in the following example.

Previous Release	Current Release

`import star.dmp.ParticleDiameterInteractionLengthScaleModel;`
`import star.multiphase.ParticleDiameterProperty;`
`...`
`PhaseInteraction phaseInteraction_1 = multiPhaseInteractionModel_0.createPhaseInteraction(PhaseInteractionTopology.DMP_PC, eulerianPhase_0, physicsContinuum_0);`
`phaseInteraction_1.enable(ParticleDiameterInteractionLengthScaleModel.class);`
`...`
`PhysicsContinuum physicsContinuum = (PhysicsContinuum) getActiveSimulation().getContinuumManager().getContinuum("Physics 1");`
`dispersedMultiphaseModel = physicsContinuum.getModelManager().getModel(DispersedMultiphaseModel.class);`
`EulerianPhase eulerianPhase = dispersedMultiphaseModel.createPhase();`
`DMPSingleComponentDropletModel dmpSingleComponentDropletModel = eulerianPhase.getModelManager().getModel(DMPSingleComponentDropletModel.class);`
`Liquid liquid = ((Liquid) dmpSingleComponentDropletModel.getMaterial());`
`ConstantMaterialPropertyMethod constantMaterialPropertyMethod =`
`  ((ConstantMaterialPropertyMethod) liquid.getMaterialProperties().getMaterialProperty(ParticleDiameterProperty.class).getMethod());`
`constantMaterialPropertyMethod.getQuantity().setValue(1e-5);`
	`import star.dmp.DmpInteractionLengthScaleModel;`
	`import star.multiphase.ConstantInteractionCoefficientMethod;`
	`...`
	`PhaseInteraction phaseInteraction_1 = multiPhaseInteractionModel_0.createPhaseInteraction(PhaseInteractionTopology.DMP_PC, eulerianPhase_0, physicsContinuum_0);`
	`phaseInteraction_1.enable(DmpInteractionLengthScaleModel.class);`
	`...`
	`DmpInteractionLengthScaleModel dmpInteractionLengthScaleModel = phaseInteraction.getModelManager().getModel(DmpInteractionLengthScaleModel.class);`
	`ConstantInteractionCoefficientMethod constantInteractionCoefficientMethod = ((InteractionLengthScaleMethodManager) dmpInteractionLengthScaleModel.getInteractionLengthScaleMethodManager()).getMethod(ConstantInteractionCoefficientMethod.class);`
	`constantInteractionCoefficientMethod.getQuantity().setValue(1e-5);`

VOF: Change to Resolved VOF-Lagrangian Transition Model

In the current release, the Resolved VOF-Lagrangian Transition Model can now convert the VOF blobs to Lagrangian parcels not only with maximum blob diameter but also with minimum blob diameter and/or blob shape metrics. This redesign has resulted in changes to the macro code.

Previous Release

```
Simulation simulation_0 =
  getActiveSimulation();
PhysicsContinuum physicsContinuum_0
=
  ((PhysicsContinuum)
simulation_0.getContinuumManager().ge
tContinuum("Physics 1"));
MultiPhaseInteractionModel
multiPhaseInteractionModel_0 =

physicsContinuum_0.getModelManager().
getModel(MultiPhaseInteractionModel.c
lass);
PhaseInteraction phaseInteraction_0
=
  ((PhaseInteraction)
multiPhaseInteractionModel_0.getPhase
InteractionManager().getPhaseInteract
ion("Phase Interaction 1"));
phaseInteraction_0.enable(ResolvedVof
LagrangianTransitionModel.class);
ResolvedVofLagrangianTransitionModel
resolvedVofLagrangianTransitionModel_
0 =

phaseInteraction_0.getModelManager().
getModel(ResolvedVofLagrangianTransit
ionModel.class);
VofLagrangianTransitionLengthScalePro
file
vofLagrangianTransitionLengthScalePro
file_0 =

resolvedVofLagrangianTransitionModel_
0.getTransitionLengthScaleProfile();
vofLagrangianTransitionLengthScalePro
file_0.getMethod(ConstantScalarProfil
eMethod.class).getQuantity().setValu
e(1.0E-4);
Units units_0 =
  ((Units)
simulation_0.getUnitsManager().getObj
ect("m"));
vofLagrangianTransitionLengthScalePro
file_0.getMethod(ConstantScalarProfil
eMethod.class).getQuantity().setUnit
s(units_0);
```

Current Release

```
Simulation simulation_0 =
  getActiveSimulation();
PhysicsContinuum physicsContinuum_0
=
  ((PhysicsContinuum)
simulation_0.getContinuumManager().ge
tContinuum("Physics 1"));
MultiPhaseInteractionModel
multiPhaseInteractionModel_0 =

physicsContinuum_0.getModelManager().
getModel(MultiPhaseInteractionModel.c
lass);
PhaseInteraction phaseInteraction_0
=
  ((PhaseInteraction)
multiPhaseInteractionModel_0.getPhase
InteractionManager().getPhaseInteract
ion("Phase Interaction 1"));
phaseInteraction_0.enable(ResolvedVof
LagrangianTransitionModel.class);
ResolvedVofLagrangianTransitionModel
resolvedVofLagrangianTransitionModel_
0 =

phaseInteraction_0.getModelManager().
getModel(ResolvedVofLagrangianTransit
ionModel.class);
BlobDiameterVofLagrangianTransitionCr
iterion
blobDiameterVofLagrangianTransitionCr
iterion_0 =

((BlobDiameterVofLagrangianTransition
Criterion)
resolvedVofLagrangianTransitionModel_
0.getCriterionManager().getObject("Bl
ob Diameter Criterion"));
Units units_0 =
  ((Units)
simulation_0.getUnitsManager().getObj
ect("m"));
blobDiameterVofLagrangianTransitionCr
iterion_0.getMaxDiameter().setValue(1
.0E-4);
blobDiameterVofLagrangianTransitionCr
iterion_0.getMaxDiameter().setUnits(u
nits_0);
blobDiameterVofLagrangianTransitionCr
iterion_0.getMinDiameter().setValue(0
.0);
blobDiameterVofLagrangianTransitionCr
iterion_0.getMinDiameter().setUnits(u
nits_0);
```

Previous Release	Current Release
	BlobShapeVofLagrangianTransitionCriterion blobShapeVofLagrangianTransitionCriterion_0 = ((BlobShapeVofLagrangianTransitionCriterion) resolvedVofLagrangianTransitionModel_0.getCriterionManager().getObject("Blob Shape Criterion")); resolvedVofLagrangianTransitionModel_0.getCriterionManager().removeObjects(blobShapeVofLagrangianTransitionCriterion_0);

Electromagnetism

Change to Setup of Coils

The setup of excitation coils has been restructured, resulting in changes to the macro code.

Previous Release	Current Release

ExcitationCoilElectricCurrentDensityMagnitudeProfile excitationCoilElectricCurrentDensityMagnitudeProfile_0
 	
= region_4.getValues().get(ExcitationCoilElectricCurrentDensityMagnitudeProfile.class);
 	
excitationCoilElectricCurrentDensityMagnitudeProfile_0.getMethod(ExcitationCoilAmpereTurnMethod.class).setNSections(2);
 	
ExcitationCoilConductorRelativeOrAbsoluteArea excitationCoilConductorRelativeOrAbsoluteArea_0 =
 	
excitationCoilElectricCurrentDensityMagnitudeProfile_0.getMethod(ExcitationCoilAmpereTurnMethod.class).getCoilArea();
 	
excitationCoilConductorRelativeOrAbsoluteArea_0.getRelativeOrAbsoluteOption().setSelected(ExcitationCoilConductorRelativeOrAbsoluteAreaOption.Type.ABSOLUTE);
 	
((ExcitationCoilConductorAbsoluteArea) excitationCoilConductorRelativeOrAbsoluteArea_0.getAbsoluteArea());
	import star.electromagnetism.common.ExcitationCoilNSections;
	
	ExcitationCoilNSections excitationCoilNSections = region_4.getValues().get(ExcitationCoilNSections.class);
	
	excitationCoilNSections.getModelPartValue().setValue(2);
	
	import star.electromagnetism.common.ExcitationCoilConductorArea;
	
	import star.electromagnetism.common.ExcitationCoilConductorAreaLeaf;
	
	ExcitationCoilConductorArea excitationCoilConductorArea_0 = region_5.getValues().get(ExcitationCoilConductorArea.class);
	
	ExcitationCoilConductorAreaLeaf excitationCoilConductorAreaLeaf_0 = excitationCoilConductorArea_0.getModelPartValue();excitationCoilConductorAreaLeaf_0.getRelativeOrAbsoluteOption().setSelected(ExcitationCoilConductorRelativeOrAbsoluteAreaOption.Type.ABSOLUTE);
	
	((ExcitationCoilConductorAbsoluteArea

Previous Release	Current Release
	) excitationCoilConductorAreaLeaf_0.get AbsoluteArea());

Changes to Permanent Magnet Modeling

Whenever a physics continuum activates the Permanent Magnet Model, you are advised to make sure that it is the default model by activating the Linear Permanent Magnet General Model, as in the following example:

```
    PhysicsContinuum pc =
sim.getContinuumManager().createContinuum(PhysicsContinuum.class);
// ...
    pc.enable(PermanentMagnetModel.class);
    pc.enable(LinearPermanentMagnetGeneralModel.class);
```

To make this default model available it is necessary to import it from `magneticpotential`, as in the following line:

```
import
star.electromagnetism.magneticpotential.LinearPermanentMagnetGeneralModel;
```

Battery Modeling: Changes to Workflow

A new workflow has been introduced for battery modeling in Simcenter STAR-CCM+, resulting in changes to the macro code.

The following classes have been replaced as follows:

- `BatteryCell` has been replaced by `BatteryCellBase`.
- `BatteryModule` has been replaced by `TBMBatteryModule`.
- `BatteryModuleCell` has been replaced by `TBMBatteryModuleCell`.
- `BlockCellModelDescription` has been replaced by `BlockModelGeometry`.
- `CylindricalCellModelDescription` has been replaced by `CylindricalModelGeometry`.
- `PrismaticCellModelDescription` has been replaced by `PrismaticModelGeometry`.

In some cases casting to the appropriate class may be required.

Update your macro codes for these parameters as follows:

Creating a new `TBMBatteryModule`:

Previous Release	Current Release
BatteryModule batteryModule_0 = batteryTool_0.getModules().createEmpt yBatteryModule();	TBMBatteryModule batteryModule_0 = (TBMBatteryModule) (batteryTool_0.getModules()).createTB MBatteryModule();

Using a `<Shape>ModelGeometry`:

Previous Release	Current Release
`<Shape>CellModelDescription cellModelDescription_0 = ((<Shape>CellModelDescription) <shape>BatteryCell_0.getCellModelDescription());`	`<Shape>ModelGeometry modelGeometry_0 = (<Shape>ModelGeometry) <shape>BatteryCell_0.getModelGeometry());`

Looping through Battery Cells:

Previous Release	Current Release
`Collection<BatteryCell> bcs = batteryTool_0.getCells().getObjects(); for (BatteryCell bc : bcs) {`	`Collection<BatteryCellBase> bcs = batteryTool_0.getCells().getObjects(); for (BatteryCellBase bcb : bcs) { BatteryCell bc = (BatteryCell) bcb;`

Visualization

Changes to Hardcopy Export User Interface

With the introduction of anti-aliasing and transparency controls to plots and layouts, which resemble those for scenes, existing macros now export graphics files (hardcopies) of plots using anti-aliasing.

Changes to Compression for Scene Files

Due to the introduction of multiple levels of compression for the export of scene (`.sce`) files in the current release, the macro code has changed.

Previous Release	Current Release
`Simulation simulation_0 = getActiveSimulation(); Scene scene_0 = simulation_0.getSceneManager().getScene("Scene"); // export a scene file with lossless compression scene_0.export3DSceneFileAndWait(resolvePath("Scene.sce"), "Scene", "Description", false, true); ResidualPlot residualPlot_0 = ((ResidualPlot) simulation_0.getPlotManager().getPlot("Residuals")); // export a plot with lossless compression residualPlot_0.exportScene(resolvePath("Residuals.sce"), "Residuals", "", false, true);`	`Simulation simulation_0 = getActiveSimulation(); Scene scene_0 = simulation_0.getSceneManager().getScene("Scene"); // export a scene file with lossless compression scene_0.export3DSceneFileAndWait(resolvePath("Scene.sce"), "Scene", "Description", false, SceneFileCompressionLevel.LOSSLESS); // export a scene file with medium lossy compression scene_0.export3DSceneFileAndWait(resolvePath("Scene_lossy.sce"), "Scene", "Description", false, SceneFileCompressionLevel.MEDIUM); ResidualPlot residualPlot_0 = ((ResidualPlot) simulation_0.getPlotManager().getPlot("Residuals")); // export a plot with lossless compression residualPlot_0.exportScene(resolvePath("Residuals.sce"), "Residuals", "",`

Previous Release	Current Release
	false, SceneFileCompressionLevel.LOSSLESS);

Scene files can also be exported when a scene is updated during a solution run, or using an Export simulation operation. Because these now also support selecting a compression level, `getCompress()` and `setCompress()` have been deprecated and replaced with `getCompressionLevel()` and `setCompressionLevel()` in the following classes:

- `star.common.SceneFileProperties`
- `star.common.SceneExportSceneFileSettings`
- `star.common.PlotExportSceneFileSettings`

In the current release, the plot **Update** sub-node now includes the ability to select scene files as an export file type. A new `SCE` entry has been added to `star.common.PlotHardcopyFormat`, and `star.common.PlotUpdate` now also has a `getSceneFileProperties()` method. Deprecated components have been replaced as follows:

- `public boolean getCompress()` has been replaced by `public SceneFileCompressionLevel getCompressionLevel()`.
- `public void setCompress(boolean value)` has been replaced by `public void setCompressionLevel(SceneFileCompressionLevel level)`.

Previous Release	Current Release

Simulation simulation_0 =
getActiveSimulation();
Scene scene_0 =
simulation_0.getSceneManager().getSce
ne("Scene");
ResidualPlot residualPlot_0 =
((ResidualPlot)
simulation_0.getPlotManager().getPlo
t("Residuals"));
 	
SceneUpdate sceneUpdate_0 =
scene_0.getSceneUpdate();
sceneUpdate_0.setAnimationFileFormat(
ImageFileFormat.SCE);
SceneFileProperties
sceneFileProperties_0 =
sceneUpdate_0.getSceneFileProperties(
);
if (!
sceneFileProperties_0.getCompress())
{
 	
sceneFileProperties_0.setCompress(tru
e);
}
 	
SimDriverWorkflow
simDriverWorkflow_0 =
  ((SimDriverWorkflow)
simulation_0.get(SimDriverWorkflowMan
ager.class).getObject("Simulation
	Simulation simulation_0 =
	getActiveSimulation();
	Scene scene_0 =
	simulation_0.getSceneManager().getSce
	ne("Scene");
	ResidualPlot residualPlot_0 =
	((ResidualPlot)
	simulation_0.getPlotManager().getPlo
	t("Residuals"));
	
	SceneUpdate sceneUpdate_0 =
	scene_0.getSceneUpdate();
	sceneUpdate_0.setAnimationFileFormat(
	ImageFileFormat.SCE);
	SceneFileProperties
	sceneFileProperties_0 =
	sceneUpdate_0.getSceneFileProperties(
	);
	if
	(sceneFileProperties_0.getCompression
	Level() ==
	SceneFileCompressionLevel.OFF) {
	
	sceneFileProperties_0.setCompressionL
	evel(SceneFileCompressionLevel.LOSSLE
	SS);
	}
	
	PlotUpdate plotUpdate_0 =
	residualPlot_0.getPlotUpdate();
	plotUpdate_0.setAnimationFileFormat(P

Previous Release	Current Release

Operations 1"));
 	
ExportAutomationBlock
exportAutomationBlock_0 =
((ExportAutomationBlock)
simDriverWorkflow_0.getBlocks().getOb
ject("Export"));
 	
SceneExportSettings
sceneExportSettings_0 =
exportAutomationBlock_0.getSceneSetti
ngs();
sceneExportSettings_0.setExportType(S
ceneExportType.SCENE_FILE);
SceneExportSceneFileSettings
sceneExportSceneFileSettings_0 =
sceneExportSettings_0.getSceneFileSet
tings();
if
(sceneExportSceneFileSettings_0.getCo
mpress()) {
 	
sceneExportSceneFileSettings_0.setCom
press(false);
}
 	
PlotExportSettings
plotExportSettings_0 =
exportAutomationBlock_0.getPlotSettin
gs();
plotExportSettings_0.setExportType(Pl
otExportType.SCENE_FILE);
PlotExportSceneFileSettings
plotExportSceneFileSettings_0 =
plotExportSettings_0.getSceneFileSett
ings();
if
(plotExportSceneFileSettings_0.getCom
press()) {
 	
plotExportSceneFileSettings_0.setComp
ress(false);
}
	lotHardcopyFormat.SCE);
	SceneFileProperties
	sceneFileProperties_1 =
	plotUpdate_0.getSceneFileProperties()
	;
	if
	(sceneFileProperties_1.getCompression
	Level() ==
	SceneFileCompressionLevel.OFF) {
	
	sceneFileProperties_1.setCompressionL
	evel(SceneFileCompressionLevel.LOSSLE
	SS);
	}
	
	SimDriverWorkflow
	simDriverWorkflow_0 =
	((SimDriverWorkflow)
	simulation_0.get(SimDriverWorkflowMan
	ager.class).getObject("Simulation
	Operations 1"));
	
	ExportAutomationBlock
	exportAutomationBlock_0 =
	((ExportAutomationBlock)
	simDriverWorkflow_0.getBlocks().getOb
	ject("Export"));
	
	SceneExportSettings
	sceneExportSettings_0 =
	exportAutomationBlock_0.getSceneSetti
	ngs();
	sceneExportSettings_0.setExportType(S
	ceneExportType.SCENE_FILE);
	SceneExportSceneFileSettings
	sceneExportSceneFileSettings_0 =
	sceneExportSettings_0.getSceneFileSet
	tings();
	if
	(sceneExportSceneFileSettings_0.getCo
	mpressionLevel() ==
	SceneFileCompressionLevel.LOSSLESS) {
	
	sceneExportSceneFileSettings_0.setCom
	pressionLevel(SceneFileCompressionLev
	el.OFF);
	}
	
	PlotExportSettings
	plotExportSettings_0 =
	exportAutomationBlock_0.getPlotSettin
	gs();
	plotExportSettings_0.setExportType(Pl
	otExportType.SCENE_FILE);
	PlotExportSceneFileSettings
	plotExportSceneFileSettings_0 =
	plotExportSettings_0.getSceneFileSett
	ings();
	if
	(plotExportSceneFileSettings_0.getCom
	pressionLevel() ==

Previous Release	Current Release

	SceneFileCompressionLevel.LOSSLESS) {
	
	plotExportSceneFileSettings_0.setCompressionLevel(SceneFileCompressionLevel.OFF);
	}

Changes to Handling of Annotations

Refactoring of annotations has resulted in changes to the macro code for adding and removing annotations.

Previous Release	Current Release

Simulation simulation_0 =
  getActiveSimulation();
ResidualPlot residualPlot_0 =
  ((ResidualPlot)
simulation_0.getPlotManager().getPlot("Residuals"));
LogoAnnotation logoAnnotation_0 =
  ((LogoAnnotation)
simulation_0.getAnnotationManager().getObject("Logo"));
LogoAnnotationProp
logoAnnotationProp_0 =
  (LogoAnnotationProp)
residualPlot_0.getAnnotationPropManager().createPropForAnnotation(logoAnnotation_0);
residualPlot_0.getAnnotationPropManager().removePropsForAnnotations(logoAnnotation_0);
	Simulation simulation_0 =
	  getActiveSimulation();
	ResidualPlot residualPlot_0 =
	  ((ResidualPlot)
	simulation_0.getPlotManager().getPlot("Residuals"));
	residualPlot_0.getAnnotationPropManager().getAnnotationGroup().setQuery(null);
	LogoAnnotation logoAnnotation_0 =
	  ((LogoAnnotation)
	simulation_0.getAnnotationManager().getObject("Logo"));
	residualPlot_0.getAnnotationPropManager().getAnnotationGroup().setObjects(logoAnnotation_0);
	residualPlot_0.getAnnotationPropManager().getAnnotationGroup().setQuery(null);
	residualPlot_0.getAnnotationPropManager().getAnnotationGroup().setObjects();

`createPropForAnnotation` has been deprecated. Replace instances of it with `createAnnotationProp` as shown in the following example:

```
Simulation simulation_0 =
  getActiveSimulation();
ResidualPlot residualPlot_0 =
  ((ResidualPlot) simulation_0.getPlotManager().getPlot("Residuals"));
LogoAnnotation logoAnnotation_0 =
  ((LogoAnnotation) simulation_0.getAnnotationManager().getObject("Logo"));
residualPlot_0.getAnnotationPropManager().createAnnotationProp(logoAnnotation_0);
residualPlot_0.getAnnotationPropManager().removePropsForAnnotations(logoAnnotation_0);
```

Design Manager: Changes to Compute Resources

In the current release all compute resources were moved under **Tools**, resulting in changes to the macro code.

The Java classes `MdxDirectSettings`, `MdxJobManagerSettings`, `MdxLinuxClusterSettings`, and `MdxWindowsHPCClusterSettings` have been removed. Macros with these classes are not supported, and the macro compilation will fail.

The methods in the `MdxComputeResource` Java class to get settings have also been removed:

- `getDirectSettings()`
- `getLinuxClusterSettings()`
- `getWindowsHPCClusterSettings()`
- `getJobManagerSettings()`

You should update your macros to use the new resource classes `MdxDirectResource`, `MdxJobManagerResource`, `MdxLinuxClusterResource`, and `MdxWindowsHPCClusterResource`, as shown in the following examples.

Direct

Previous Release	Current Release

`MdxProject mdxProject_0 = getActiveMdxProject();`
`MdxDesignStudy study = mdxProject_0.getDesignStudyManager().getDesignStudy("Sweep");`
`MdxStudySettings study = study.getStudySettings();`
`MdxComputeResource mdxComputeResource_0 = study.getComputeResource();`
`mdxComputeResource_0.setType(MdxComputeResource.ResourceType.DIRECT);`
`MdxDirectSettings mdxDirectSettings_0 = mdxComputeResource_0.getDirectSettings();`
`mdxDirectSettings_0.setCcmpCmd("power pre");`
	`MdxProject mdxProject_0 = getActiveMdxProject();`
	`MdxDesignStudy study = mdxProject_0.getDesignStudyManager().getDesignStudy("Sweep");`
	`MdxDirectResource mdxDirectResource_0 = mdxProject_0.get(MdxResourceManager.class).createResource(MdxDirectResource.class);`
	`MdxLaunchSettings mdxLaunchSettings_0 = mdxStudySettings_0.getLaunchSettings();`
	`mdxLaunchSettigns_0.setResourceMode(MdxLaunchSettings.ResourceMode.SINGLE_RESOURCE);`
	`MdxSingleResourceSettings mdxSingleResourceSettings_0 = mdxLaunchSettings_0.getSingleResourceSettings();`
	`mdxSingleResourceSettings_0.setResource(mdxDirectResource_0);`
	`mdxDirectResource_0.setCcmpCmd("power pre");`

Linux Cluster

Previous Release	Current Release

`mdxComputeResource_0.setType(MdxComputeResource.ResourceType.LINUX_CLUSTER);`
`MdxLinuxClusterSettings mdxLinuxClusterSettings_0 = mdxComputeResource_0.getLinuxClusterSettings();`
`mdxLinuxClusterSettings_0.setCcmpCmd("power");`
`mdxLinuxClusterSettings_0.setJobSubmitCmd("qsub -l nodes=1:ppn=8");`
`mdxLinuxClusterSettings_0.setJobNameIdentifier("-n");`
`mdxLinuxClusterSettings_0.setJobNameP`
	`MdxLinuxClusterResource mdxLinuxClusterResource_0 = mdxProject_0.get(MdxResourceManager.class).createResource(MdxLinuxClusterResource.class);`
	`mdxSingleResourceSettings_0.setResource(mdxLinuxClusterResource_0);`
	`mdxLinuxClusterResource_0.setCcmpCmd("powerpre");`
	`mdxLinuxClusterResource_0.setJobSubmitCmd("qsub -l nodes=1:ppn=8");`
	`mdxLinuxClusterResource_0.setJobNameIdentifier("-n");`
	`mdxLinuxClusterResource_0.setJobNameP`

Previous Release	Current Release
refix("dm_design"); mdxLinuxClusterSettings_0.setScriptFile("script.sh");	refix("dm_design"); mdxLinuxClusterResource_0.setScriptFile("script.sh");

Windows Cluster

Previous Release	Current Release

mdxComputeResource_0.setType(MdxComputeResource.ResourceType.WINDOWS_CLUSTER);
MdxWindowsHPCClusterSettings mdxWindowsHPCClusterSettings_0 = mdxComputeResource_0.getWindowsHPCClusterSettings();
mdxWindowsHPCClusterSettings_0.setCcmpCmd("power");
mdxWindowsHPCClusterSettings_0.setJobSubmitCmd("job submit /numcores:16");
mdxWindowsHPCClusterSettings_0.setJobNameIdentifier("/jname");
mdxWindowsHPCClusterSettings_0.setJobNamePrefix("dm_design");
mdxWindowsHPCClusterSettings_0.setScriptFile("script.sh");
	MdxWindowsHPCClusterResource mdxWindowsHPCClusterResource_0 = mdxProject_0.get(MdxResourceManager.class).createResource(MdxWindowsHPCClusterResource.class);
	mdxSingleResourceSettings_0.setResource(mdxWindowsHPCClusterResource_0);
	mdxWindowsHPCClusterResource_0.setCcmpCmd("power");
	mdxWindowsHPCClusterResource_0.setJobSubmitCmd("job submit /numcores:16");
	mdxWindowsHPCClusterResource_0.setJobNameIdentifier("/jname");
	mdxWindowsHPCClusterResource_0.setJobNamePrefix("dm_design");
	mdxWindowsHPCClusterResource_0.setScriptFile("script.sh");

Job Manager

Previous Release	Current Release

mdxComputeResource_0.setType(MdxComputeResource.ResourceType.JOB_MANAGER);
MdxJobManagerSettings mdxJobManagerSettings_0 = mdxComputeResource_0.getJobManagerSettings();
mdxJobManagerSettings_0.setCcmpCmd("power");
mdxJobManagerSettings_0.setJobManagerKey("url:8100");
mdxJobManagerSettings_0.setSubmissionTemplate("NIGHTLY");
	MdxJobManagerResource mdxJobManagerResource_0 = mdxProject_0.get(MdxResourceManager.class).createResource(MdxJobManagerResource.class);
	mdxSingleResourceSettings_0.setResource(mdxJobManagerResource_0);
	mdxJobManagerResource_0.setCcmpCmd("power");
	mdxJobManagerResource_0.setJobManagerKey("url:8100");
	mdxJobManagerResource_0.setSubmissionTemplate("NIGHTLY");

Local CAD Update

Previous Release	Current Release
mdxComputeResource_0.setType(MdxComputeResource.ResourceType.LOCAL_CAD_UPDATE); MdxLocalCadUpateSettings lcUpdateSettings = mdxComputeResource_0.getLocalCadUpdateSettings();	mdxLaunchSettigns_0.setResourceMode(MdxLaunchSettings.ResourceMode.LOCAL_CAD_UPDATE); MdxLocalCadUpateSettings lcUpdateSettings = mdxLaunchSettings_0.getLocalCadUpdateSettings();

CAE Integration: Changes to CGNS Import

Improvements in time interpolation have resulted in changes to macro codes for CGNS import.

Previous Release

```
import
star.cosimulation.oneway.common.*;
...
public void execute() {
    Simulation simulation_0 =
      getActiveSimulation();
    CoSimulation coSimulation_0 =
      ((CoSimulation)
simulation_0.get(CoSimulationManager.
class).getObject("Link 1"));
    TransferStartTime
transferStartTime_0 =

coSimulation_0.getCoSimulationValues(
).get(TransferStartTime.class);
    ...
    TransferStopTime
transferStopTime_0 =

coSimulation_0.getCoSimulationValues(
).get(TransferStopTime.class);
    ...
    TimeStepsPerTransfer
timeStepsPerTransfer_0 =

coSimulation_0.getCoSimulationValues(
).get(TimeStepsPerTransfer.class);
    ...
}
```

Current Release

```
// The directory
star.cosimulation.oneway.common is
no longer used
// Use star.cosimulation.link.common
instead

import
star.cosimulation.link.common.*;
...
public void execute() {
    Simulation simulation_0 =
      getActiveSimulation();
    CoSimulation coSimulation_0 =
      ((CoSimulation)
simulation_0.get(CoSimulationManager.
class).getObject("Link 1"));
    // TransferStartTime has moved:
    //    FROM
star.cosimulation.oneway.common
    //    TO
star.cosimulation.link.common
    TransferStartTime
transferStartTime_0 =

coSimulation_0.getCoSimulationValues(
).get(TransferStartTime.class);
    ...
    // TransferStopTime has moved:
    //    FROM
star.cosimulation.oneway.common
    //    TO
star.cosimulation.link.common
    TransferStopTime
transferStopTime_0 =

coSimulation_0.getCoSimulationValues(
).get(TransferStopTime.class);
    ...
    // TimeStepsPerTransfer has been
renamed to TimeStepFrequency and
moved:
    //    FROM
star.cosimulation.oneway.common
    //    TO
star.cosimulation.link.common
    TimeStepFrequency
timeStepFrequency_0 =

coSimulation_0.getCoSimulationValues(
).get(TimeStepFrequency.class);

timeStepFrequency_0.setFrequency(5);
    ...
}
```

Co-Simulation: Change to Abaqus Mapping Options

The user interface for Abaqus co-simulation has been improved, resulting in changes to the macro code.

Previous Release	Current Release

`CoSimulation coSimulation_0 = ((CoSimulation) simulation_0.get(CoSimulationManager.class).getObject("Link 1"));`
`CoSimulationZone coSimulationZone_0 = coSimulation_0.getCoSimulationZoneManager().getCoSimulationZone("Zone 1");`
`MapperSettings mapperSettings_0 = coSimulationZone_0.getCoSimulationZoneValues().get(MapperSettings.class);`
`mapperSettings_0.getMapperRefConfig().setSelected(MapperRefConfigOptions.Type.CURRENT);`
	`CoSimulation coSimulation_0 = ((CoSimulation) simulation_0.get(CoSimulationManager.class).getObject("Link 1"));`
	`coSimulation_0.getCoSimulationConditions().get(DisplacementReferenceConfigurationOption.class).setSelected(DisplacementReferenceConfigurationOption.Type.CURRENT);`

CAD Packages Support

This section contains a list of supported CAD Clients, the CAD import versions, and the CAD export versions.

CAD Packages for CAD Clients

When installing CAD Clients, the target CAD package must be present on the installation machine. Without this, you can force the installation of a particular sub-component, but there is no guarantee that this will work correctly with your CAD package. The following CAD packages are required to run the CAD Clients:

CAD Client	CAD Package Version	Comments
Simcenter STAR-CCM+ Client for CATIA V5	CATIA V5-6R2017 (R27)	An additional `ME2` or `MD2 + GPS` configuration license is required from Dassault Systemes to run Simcenter STAR-CCM+ Client for CATIA V5.
	CATIA V5-6R2018 (R28)	
	CATIA V5-6R2019 (R29)	
	CATIA V5-6R2020 (R30)	
Simcenter STAR-CCM+ Client for NX	NX 12.0*	* For these versions you can use the batch version of NX or Simcenter 3D on Linux in conjunction with Simcenter STAR-CCM+.
	NX 1847	
	NX 1872/Simcenter 3D 2019.2*	
	NX 1899/Simcenter 3D 2020.1*	
	NX 1926/Simcenter 3D 2020.2*	
	NX 1953/Simcenter 3D 2021.1	
	NX 1980/Simcenter 3D 2021.2*	
Simcenter STAR-CCM+ Client for Creo	Creo Parametric 4.0	
	Creo Parametric 5.0	
	Creo Parametric 6.0	
	Creo Parametric 7.0	
	Creo Parametric 8.0	
Simcenter STAR-CCM+ Client for Inventor	Inventor 2017	
	Inventor 2018	
	Inventor 2019	
	Inventor 2020	
	Inventor 2021	

CAD Import Versions

CAD File Formats for HOOPS Exchange

CAD import is available on all platforms. The supported file formats and corresponding version numbers are given below. The table below shows the supported CAD file formats for HOOPS Exchange.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Import
CATIA V4	.model, .exp, .session	Up to 4.2.5	CAD Exchange	Triangulated Data, B-rep
CATIA V5	.CATPart, .CATProduct, .cgr	Up to V5-R2020 (R30)	CAD Exchange	Triangulated Data, B-rep
CATIA V6 / 3DExperience	.3dxml	Up to V6 R2019 (R9)	CAD Exchange	Triangulated Data
SolidWorks	.sldprt, .sldasm	Up to 2020	CAD Exchange	Triangulated Data, B-rep
JT Open	.jt	Up to v10.3	JTOpen Reader & CAD Exchange	Triangulated Data, B-rep
NX	.prt	Up to 1926	CAD Exchange	Triangulated Data, B-rep
Solid Edge	.par, .asm	Up to 2020	CAD Exchange	Triangulated Data, B-rep
Parasolid	.x_t, .x_b,	Up to 32	None	B-rep
Pro/E - Creo	.asm, .prt	Pro/E 19.0 to Creo 7.0	CAD Exchange	Triangulated Data, B-rep
Inventor	.ipt, .iam	Up to 2021	CAD Exchange	Triangulated Data, B-rep
IGES	.igs, .iges	5.1, 5.2, 5.3	None	B-rep
STEP	.stp, .step	AP 203 E1/E2, AP 214, AP 242	None	B-rep
Stereo Lithography (STL)	.stl	All versions	None	Triangulated Data
VDA-FS	.vda	1.0, 2.0	CAD Exchange	B-rep
Rhino 3D	.3dm	4, 5, 6	CAD Exchange	Triangulated Data, B-rep
ACIS	.sat, .sab	Up to 2020	CAD Exchange	Triangulated Data, B-rep

CAD File Formats for Siemens Adapter

The table below shows the supported CAD file formats for Siemens Adapter.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Import
CATIA V5	.CATPart, .CATProduct	Up to V5-6 R2019 SP4	None	B-rep

File Format	File Extensions	Versions Supported	Add-on Required	Type of Import
JT	.jt	Up to 10.6.1.0	None	B-rep
Solid Edge	.par, .asm	Windows up to 2020 Linux — no support	None	B-rep
STEP	.stp, .step	AP 203, AP 214, AP 242	None	B-rep
NX	.prt	Up to NX1980	None	B-rep

CAD Export Versions

CAD export is available on all platforms. 3D-CAD supports exporting to the following file formats.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Export
Parasolid	.x_t, .x_b	33.00.181	None	B-rep
IGES	.igs, .iges	5.3	CAD Exchange	B-rep
STEP	.stp, .step	AP 203 E1/E2, AP 214, AP 242	None	B-rep

External Packages Support

Simcenter STAR-CCM+ can interact with a range of third-party software tools, either by importing their meshes and data, exporting to their formats, or through co-simulation.

Third-Party Software

Simcenter STAR-CCM+ supports the following packages:

Package	Provider	Supported Versions	Import	Export	File-Based Coupling	Co-Simulation[1]
Abaqus	SIMULIA-Dassault Systemes	All	✓	✓[2]	✓	
		2021 (Linux only) **2020** (recommended) 2019 2018				✓
Simcenter Amesim	Siemens Digital Industries Software	**2019.2** (recommended) 2019.1 17	-	-	-	✓
ANSYS	ANSYS Inc.	All	✓[3]	✓[2]	✓	
Simcenter Battery Design Studio	Siemens Digital Industries Software	**2021.3**	✓	-	-	-
Ensight	ANSYS Inc.	**10.1** (recommended) 9 8	✓	✓[4]	-	-
FieldView	FieldView CFD	15	-	✓[4]	-	-
gPROMS	Process Systems Enterprise Limited - A Siemens Business	gPROMS FormulatedProducts 2.0 gPROMS ModelBuilder 7.0 gPROMS ProcessBuilder 2.0	-	✓[4]	✓	-
GT-SUITE	Gamma Technologies Inc.	**2019** (recommended) 2018 2017	-	-	-	✓
JMAG	JSOL Corporation	JSOL defines the JMAG versions that are supported				✓
Simcenter Nastran	Siemens Digital Industries Software	All	✓[3]	✓[2]	✓	
		2020.1-1915 2020.2-1938				✓

Package	Provider	Supported Versions	Import	Export	File-Based Coupling	Co-Simulation[1]
		2021.1-1965				
MSC Nastran	MSC Software Solutions	All	✓[3]	✓[2]	✓	-
TAITherm (Formerly known as RadTherm)	ThermoAnalytics Inc.	All	✓	✓[2]	✓	-
RELAP5-3D	Idaho National Laboratory	**4.1.3**[5]		-	-	✓
Simcenter SPEED	Siemens Digital Industries Software	**2021.3**	✓	-	-	-
Tecplot 360	Tecplot Inc.	**2015**		✓[4]	-	-
WAVE	Ricardo	**2017.1** (recommended) 2016.2 2016.1				✓

[1] Currently, co-simulation does not support host specification using the IPv6 communication protocol
[2] Exports solution data, but not the mesh
[3] There is no version restriction on the files to import
[4] Exports mesh and solution data
[5] Specially modified version; must be obtained from INL.

Known Issues

This section contains a list of known issues that may occur in special circumstances. None of the issues affect the validity of the results that you obtain with Simcenter STAR-CCM+.

In the following topics, the symbol New is used to identify issues that are new in this release. Only issues where resolution is related to a third-party product or system provider, and is outside of our control, are listed here.

A number of these issues pertain to Message Passing Interfaces (MPIs). For more information about MPIs, see "Supported MPI Implementations" in the Simcenter STAR-CCM+ User Guide.

Contents:

Issues Relevant to All Operating Systems

This section contains a list of known issues that affect Simcenter STAR-CCM+ on all operating systems.

Limitation of Co-Simulation with Certain Versions of Simcenter Nastran New

Simcenter STAR-CCM+ supports co-simulation with Simcenter Nastran with versions 2020.1 - 1915 , 2020.2 - 1938 , and 2021.1 - 1965. However, co-simulation with Simcenter Nastran 2020.2 - 1938 gives overdamped behavior and 2021.1 - 1965 gives wrong displacements when the solid model is solved in the local coordinate system. Hence it is recommended to use Simcenter Nastran version 2020.1 - 1915 for co-simulation in such cases.

MPI Issues Found with Simcenter STAR-CCM+ to Simcenter STAR-CCM+ Co-Simulation

Issues have been observed when MPI applications are used to spawn a second parallel Simcenter STAR-CCM+ simulation from an existing parallel simulation.

You are advised to use Resource Manager for this type of co-simulation. See the section "Running a Co-Simulation Using Resource Manager" in the Simcenter STAR-CCM+ User Guide.

Custom Display Scaling Not Supported in Current Release

In the current release, it is recommended that you avoid using your system display settings for scaling Simcenter STAR-CCM+. Issues have been observed such as blurry fonts, incorrectly registered mouse clicks, and the inability to select objects in a scene display.

To prevent scaling of Simcenter STAR-CCM+ in Linux, add `-jvmargs -Dsun.java2d.uiScale=1.0` to the command line.

To change the size of Simcenter STAR-CCM+ client fonts, see either of the following:

- All platforms: "Changing the Workspace Font Size" in the Simcenter STAR-CCM+ User Guide
- Windows 10: Preventing Windows from Scaling Simcenter STAR-CCM+

Flexera Publisher 2019 R2 Recommended to Avoid Security Vulnerabilities

Kaspersky labs have identified four possible vulnerabilities in versions of FlexNet Publisher version 2018 R3 (11.14) and earlier. While there are no known exploits of these vulnerabilities, it is possible they could result in a DoS (Denial of Service) attack if they were to be exploited. If the Simcenter STAR-CCM+ license server is running on a secure network, as is recommended, then there is no way of exploiting these vulnerabilities except from within the firewall.

To mitigate any possible concerns over this issue FlexNet Publisher 2019 R2 (11.16.4) is available for download from the support center. To patch your existing Simcenter STAR-CCM+ license server simply replace your existing `lmgrd` executable with the new one and restart your server.

AVX-512 Optimizations on Newer Intel CPUs Can Lead to Spurious Numerical Failures

Simcenter STAR-CCM+ finite element solvers and some meshing modules depend on the Intel Math Kernel Library (MKL) for performance-critical linear algebra subroutines. The AVX-512 optimizations inside the MKL library can be too aggressive and cause the linear system solution process to fail even for a valid input.

If your system has an AVX-512 capable Intel CPU and the solver fails to produce a result due to a floating point exception, you can try setting the environment variable `MKL_ENABLE_INSTRUCTIONS` to a value of `AVX2`. This setting can help to stabilize the system. For example:

- Bash shell: `export MKL_ENABLE_INSTRUCTIONS=AVX2`
- C shell (csh or tcsh): `setenv MKL_ENABLE_INSTRUCTIONS AVX2`

This setting configures the MKL library to avoid optimizations that are only appropriate for architectures more recent than Intel AVX2. For more details, see https://software.intel.com/en-us/mkl-linux-developer-guide-instruction-set-specific-dispatching-on-intel-architectures.

Hyperthreading Should be Disabled on Systems Running Simcenter STAR-CCM+

Siemens Digital Industries Software currently recommends that you disable hyperthreading on systems that will be used to run Simcenter STAR-CCM+.

Simcenter STAR-CCM+ May Not Run in Conjunction with Synergy

There are reports of Simcenter STAR-CCM+ failing to launch on platforms that use Synergy to share a mouse and keyboard between platforms. This is due to an open bug in the Java JDK, as reported on the JDK Bug System: https://bugs.openjdk.java.net/browse/JDK-6322854.

XWindows Can Cause Problems

If you use XWindows software, especially on Windows, to "display" a Simcenter STAR-CCM+ client back to the local machine from a remote machine, various problems may occur, such as the remote client not starting correctly or at all. This method of working is not supported by Simcenter STAR-CCM+. You must run the client directly on your local machine and connect to a remote Simcenter STAR-CCM+ server.

Zero-Sized Files in Some NFS Systems

In some newer NFS systems, if the disk becomes full while you are saving a simulation file, a zero-sized simulation file is written to the disk. No error message appears.

Issues Relevant to Linux

This section contains a list of known issues that affect Simcenter STAR-CCM+ on Linux operating systems.

Compatibility Issue with AMD CPUs Based on Zen 3 Microarchitecture New

Compatibility issues have been found between the AMD CPUs based on the Zen 3 microarchitecture, such as the AMD EPYC Milan CPU family, and the currently supported version of the OpenSWR Mesa driver. If you are using this type of CPU, you are advised to launch Simcenter STAR-CCM+ with the argument `-graphics mesa` (at the cost of graphics performance).

Compatibility Issues with Open MPI and UCX on Mellanox InfiniBand Systems with MLNX_OFED 4.9

On Mellanox InfiniBand clusters with MLNX_OFED 4.9 installed, to overcome compatibility issues, please specify the `-xsystemucx` command line flag when running parallel simulations with Simcenter STAR-CCM+ 2020.3 or 2021.1 and Open MPI.

UCX 1.8.0 with Special User-Defined Settings Can Lead to Silent Data Corruption

UCX version 1.8.0 has a bug that may cause data corruption when the TCP transport is used in conjunction with the shared memory transport. In Simcenter STAR-CCM+ with default settings, UCX is only used in parallel runs on Mellanox InfiniBand systems, so this issue may only occur when special user settings are applied to force the use of UCX with the affected transports.

Non-Default CPU Binding Settings Not Respected under Cray MPI

When using Cray MPI, non-default CPU binding settings specified with the `-cpubind` command line flag are not respected.

Libraries Required with Simcenter STAR-CCM+ Client for NX on Linux

To run Simcenter STAR-CCM+ Client for NX on Linux, supported versions of NX must be accompanied by the installation of the following runtime libraries:

- `libGLU.so.1`
- `libXm.so.4`

Without these libraries, an error message appears when an attempt is made to update the geometry.

Latest Workspace Fonts May Require Anti-Aliasing

On some Linux systems, the latest Simcenter STAR-CCM+ workspace fonts have had issues such as blurriness. The workaround is to activate font anti-aliasing in your operating system settings.

The following example is a workaround for activating anti-aliasing in KDE. It is offered only as an example for a particular operating system. For instructions on your operating system, refer to its user documentation.

1. Launch **KDE settings**.
2. Under **Look & Feel**, click **Appearance**.
3. Navigate to **Fonts**.
4. Next to **Use Anti-Aliasing**, choose **Enabled** from the drop-down box.

Memory Leak After Abnormal Termination with Open MPI 3 Can Cause Startup Failures

When a simulation using Open MPI 3 terminates abnormally, shared memory files from Open MPI's Vader component might be left behind in the `/dev/shm` folder. When another user runs a subsequent simulation with Open MPI on the same node, and `/dev/shm` has not been cleaned up, intermittent startup failures due to file name conflicts can occur. As workarounds, consider the following options:

- Clean up the files in `/dev/shm` after job termination.
- Instead of Open MPI version 3, use Open MPI version 4 using the flag `-mpi openmpi4`. The files in `/dev/shm` may still require clean up from previous Open MPI 3 runs.

Intel MPI 2019.5 Can Fail in MPI_Finalize

The new version of Intel MPI 2019.5 can fail in `MPI_Finalize` under certain circumstances. The issue manifests with an error message indicating a problem in `MPI_Finalize` being printed at the end of the simulation. The simulation results are not affected and there are no other known negative effects. Thus, the message can safely be ignored. To avoid the message, you can use a different MPI library if possible.

Errors Running on SLES 12.2

When running on SUSE Linux Enterprise Server 12 SP2 Linux Distribution, Simcenter STAR-CCM+ may exceed default limits on the number of processes in the `cgroup controller`, resulting in errors such as `fork: retry: No child processes`. To avoid this issue the default limits should be increased as documented in the SLES documentation.

Line Integral Convolution Does Not Work Properly with Intel Graphics Chipsets on Linux

Vector scenes that are set to display Line Integral Convolution (LIC) do not render properly on Intel graphics chipsets. This is due to issues with the Intel graphics driver. As a result, LIC is disabled on Intel graphics chipsets on Linux.

lmutil: "command not found" Error

On Linux platforms not conforming to the minimum LSB 3.0 (Linux Standard Base) requirement, a *command not found* error may appear when attempting to launch lmutil for the FLEXlm licensing. If this occurs, you must upgrade to LSB 3.0 or higher.

Minimized Dialogs on OpenSUSE

There is a reported issue with OpenSUSE 11.2 where a Simcenter STAR-CCM+ child dialog that is minimized cannot be immediately reinstated. In this instance, you must first minimize the whole Simcenter STAR-CCM+ GUI, and then maximize it again using the tab in the task bar. The child dialog should reappear after this operation.

Shared Memory Limits Too Low

Linux workstations are often configured with low limits on the amount of allowable shared memory. This restricts how much memory can be pinned by the libraries that MPI uses. These libraries can print warning messages even when only using a single host and they usually indicate the limits are set too low-even if the library isn't being used. Some example error messages are displayed below:

- Open MPI:

```
The OpenIB BTL failed to initialize while trying to allocate some locked
memory.
This typically can indicate that the memlock limits are set too low.
For most HPC installations, the memlock limits should be set to "unlimited".

The failure occurred here:

Host: compute_node.example.com
OMPI source: btl_opebib.c:114
Function: ibv_create_cq()
Device: Out of memory
Memlock limit: 32767
```

  The Open MPI Frequently Asked Questions describe how the limits are changed. See the answer to How can a system administrator (or user) change locked memory limits?.

To resolve these types of issues, set workstations to have high (or preferably unlimited) limits.

Simcenter STAR-CCM+ Viewer Fails to Run If Required Libraries Are Not Found

In the current release, Simcenter STAR-CCM+ Viewer requires the following libraries:

- `xkbcommon` and `xkbcommon-x11`—these are standard system libraries that are typically already installed.
- GNU C library version 2.12 or greater
- GIMP Toolkit (GTK+) version 2.20 or greater

If Simcenter STAR-CCM+ Viewer cannot detect these versions, it generates an error message.

If you have these versions installed on your machine and you still get this error, it may be that your `xkbcommon` and GTK+ libraries are installed in a location other than the global packages location. Simcenter STAR-CCM+ Viewer expects to find these libraries in the global packages location, typically `/usr`.

If you installed GTK+ version 2.20 or greater in a different location:

- Add the path to your `pkgconfig` directory to the `PKG_CONFIG_PATH` variable. An example bash shell command is shown below:

```
% export PKG_CONFIG_PATH=[GTK+_INSTALL_DIR]/lib/pkgxonfig:$PKG_CONFIG_PATH
```

- Add the path to your `lib` directory to the `LD_LIBRARY_PATH` variable. An example bash shell command is shown below:

```
% export LD_LIBRARY_PATH=[GTK+_INSTALL_DIR]/lib:$LD_LIBRARY_PATH
```

Similarly, if you installed the `xkbcommon` libraries in a different location, add the path to your `lib` directory to the `LD_LIBRARY_PATH` variable. An example bash shell command is shown below:

```
% export LD_LIBRARY_PATH=[XKBCOMMON_INSTALL_PATH]/lib:$LD_LIBRARY_PATH
```

Issues Relevant to Windows

This section contains a list of known issues that affect Simcenter STAR-CCM+ on Windows operating systems.

Display Issues May Result from Scaling in Windows 10

In the Display control of Windows 10 Settings, changing the scale of the display may cause a blurry appearance of Simcenter STAR-CCM+ fonts, as well as interfere with selection of objects in a scene display.

Preventing Windows from Scaling Simcenter STAR-CCM+

1. Right-click the desktop shortcut icon of Simcenter STAR-CCM+ and select **Properties**.
2. Make the **Compatibility** tab active.
3. Activate the option **Disable display scaling on high DPI settings**.

   Note: This option may have a different label, depending on your version of Windows 10. For example, it may read **Override high DPI scaling behavior.**
4. Make the **Shortcut** tab active.
5. In the **Target** text box, if the path is to a `.bat` file, replace that path with that of the `.exe` file, for example:

   ```
   C:\Program Files\Siemens\16.04.006\STAR-CCM+16.04.006\star\lib
   \win64\intel20.1vc14.2\lib\starccm+.exe
   ```
6. After you make that change, if the font appears too small in Simcenter STAR-CCM+, increase it as follows:
   a. Make the **Shortcut** tab active.
   b. In the **Target** text box, append `-fontsize 18` at the end.
   c. If desired, change the value after `-fontsize` to a different number.

Some Scene/Plot Exports Fail on Windows When Output Points to Linux Network Folder

When using Simcenter STAR-CCM+ on Windows, if you attempt to export certain data from a scene (hardcopy image) or a plot (hardcopy image or `.csv` file) to a location on a Linux host that is mapped to your Windows drive via Samba sharing, Simcenter STAR-CCM+ generates a message that the selected location is "not writable". This occurs even when you have full write permission on the Samba drive.

In this situation, it is recommended that you export such files to your local Windows drive.

Exiting Some Screenshot Tools Causes Simcenter STAR-CCM+ Client Exception

When you take screenshots with software such as the Windows 7 Snipping Tool or SnagIt, the Simcenter STAR-CCM+ client may undergo a fatal error after you exit the screenshot tool. Such an error can also occur when you reactivate Simcenter STAR-CCM+ after exiting the screenshot tool.

To prevent this error, do one of the following:

- Manually activate an application other than Simcenter STAR-CCM+ before closing the screenshot tool. You can then switch to Simcenter STAR-CCM+ from the third application without causing the fatal error.
- Minimize the screenshot tool but leave it running.

Context-Sensitive Help Not Compatible with Microsoft Edge

When using Microsoft Edge as the default browser, help pages do not open at the correct location when you press `F1` for a selected node in the simulation tree. To avoid this issue, use an alternative browser such as Firefox or Google Chrome.

Black Picture Appears in PowerPoint When Playing Movie Files From Simcenter STAR-CCM+

On some systems, movie (.avi) files recorded using Simcenter STAR-CCM+ may not play back in Microsoft PowerPoint. This is potentially a problem with incompatible hardware acceleration, as discussed on the following Microsoft webpage: http://office.microsoft.com/en-us/powerpoint-help/my-movie-doesn-t-play-HA010077716.aspx

The recommended response is to turn down your hardware acceleration setting, which is found in the Control Panel.

Default Scene Lighting

If you have an older graphics card that supports an older version of OpenGL, the default lighting in a scene in Simcenter STAR-CCM+ can result in hardcopies that are too dark or poorly lit. To improve the output, use a different lighting setup, such as a headlight.

Internet Explorer May Block Access to the Help System

When using Internet Explorer to access the User Guide, you may see the following message:

```
To help protect your security, Internet Explorer has restricted this file from
showing active content that could access your computer.
```

You can then click for the option to **Allow Blocked Content**, which will then produce a Security Warning that says:

```
Allowing active content such as script and ActiveX controls can be useful, but
active content might also harm your computer.
Are you sure you want to let this file run active content?
```

To allow this content to run without getting blocked please follow these steps:

1. Open Internet Explorer.
2. Go to the **Tools** > **Internet Options** > **Advanced** tab.
3. Scroll down to the section labeled *Security*.
4. Activate the **Allow active content to run in files on My Computer** option.
5. Click **OK** and then close the *Internet Options* window.

Warnings About Network Access

If you have a personal firewall (for example, Norton Internet Services) that is set up to warn you about network access from your computer, you may get warnings about an IP address being accessed on port `47827`. This is caused by the session locator sending a multicast query looking for Simcenter STAR-CCM+ servers on your local network.

When the client is started without a specified simulation file (the default when Simcenter STAR-CCM+ is started via the **Start** > **[programs menu]** > **Siemens Simcenter STAR-CCM+** > **Simcenter STAR-CCM+ [version**

number] [(build number)] menu on Windows 10), the session locator is started (in case you are attempting to connect to a running server). If you then open a simulation file or connect to a running server, the session locator stops. It restarts if you go to the *Servers* tab in the Simcenter STAR-CCM+ explorer window.

Open that port to prevent the warning, or if you are running from the command line, the `-loc` argument prevents the session locator starting.

Issues Relevant to the CAD Clients

This section contains known issues that affect the CAD Clients.

Simcenter STAR-CCM+ Installer Chooses to Install NX Components Even Though NX is not Installed

On a machine where NX has been installed and subsequently removed, the Simcenter STAR-CCM+ installer may choose to install the NX components even though the CAD software is no longer present. This is due to the NX uninstaller not removing all relevant information from the Windows registry.

Credits

Simcenter STAR-CCM+ makes use of several third party software components to provide certain features within its code.

For details about the licensing of these components, refer to the file `ReadMe_OSS.html` which is included in the root installation directory of Simcenter STAR-CCM+: 16.06.###/STAR-CCM+16.06.###.

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