COMSOL® Software – Release Highlights History

COMSOL Multiphysics® Software					
Geometry and Mesh	4.X	5.0–2	5.3	5.4	5.5
Virtual geometry operations	✓	✓	✓	✓	✓
Image import	✓	✓	✓	✓	✓
STL export	✓	✓	✓	✓	✓
NASTRAN® program mesh export	✓	✓	✓	✓	✓
Loft, fillet, chamfer, thickening, and midsurfacing with the Design Module		✓	✓	✓	✓
New tetrahedral mesher		✓	✓	✓	✓
Element quality optimizer		✓	✓	✓	✓
Performance improvements for large models by a factor of 5 or more			✓	✓	✓
Automatic removal of geometric detail for more flexible meshing			✓	✓	✓
Automatic pyramid transitions from hex to tet elements			✓	✓	✓
Parametric models with user-defined functions			✓	✓	✓
Extended mesh adaption and refinement for all element types and imported meshes				✓	✓
New sketching tools for 2D drawings					✓
Dimensions and constraints for new sketch tools with Design Module					✓
Associative geometry import					✓
Direct Meshing of imported surface meshes					✓
Import and export 3MF and PLY file formats					✓
Modeling Tools	4.X	5.0–2	5.3	5.4	5.5
Coordinate-based selections	✓	✓	✓	✓	✓
Automatic curvilinear coordinate systems	✓	✓	✓	✓	✓
New COMSOL Desktop® environment	✓	✓	✓	✓	✓
Material sweeps		✓	✓	✓	✓
Open and inspect MPH-files without add-on licenses		✓	✓	✓	✓
Autocomplete for parameters, variables, and equations		✓	✓	✓	✓
Model methods for programming Model Builder tasks			✓	✓	✓
PDE modeling with the boundary element method (BEM)			✓	✓	✓
Copy-paste physics interfaces or model components			✓	✓	✓
Model methods in the model tree with input arguments			✓	✓	✓
Colored selections for geometry and physics				✓	✓
Multiple Parameter nodes and Parameter Cases				✓	✓
Node groups for organizing the model tree				✓	✓
Custom settings windows				✓	✓

*4.X includes 4.2, 4.2a, 4.3, 4.3a, 4.3b, and 4.4 versions.
*5.0–1 includes 5.0, 5.0.1, and 5.1 versions.
*5.2 includes 5.2 and 5.2a versions.
*5.3 includes 5.3 and 5.3a versions.

Studies and Solvers	4.X	5.0–2	5.3	5.4	5.5
Time-dependent adaptive meshing	✓	✓	✓	✓	✓
Automatic remeshing	✓	✓	✓	✓	✓
Cluster sweeps and cloud computing	✓	✓	✓	✓	✓
Multiparameter sweeps	✓	✓	✓	✓	✓
Smoothed AMG solver		✓	✓	✓	✓
Optimized domain decomposition solver		✓	✓	✓	✓
Model reduction based on modal analysis and asymptotic waveform evaluation (AWE)			✓	✓	✓
Algebraic multigrid (AMG) solver for CFD			✓	✓	✓
Combine two solutions into one			✓	✓	✓
Direct and iterative solver suggestions			✓	✓	✓
Several times faster solving in the Windows® operating system				✓	✓
Parameter sweeps over Parameter Cases				✓	✓
Optimization for parametric sweeps with derivative-free methods				✓	✓
Distributed solution data storage on clusters					✓
Multigrid performance improvements on clusters					✓
Results and Visualization	**4.X**	**5.0–2**	**5.3**	**5.4**	**5.5**
Report Generator	✓	✓	✓	✓	✓
Interactive slice and isosurface plots	✓	✓	✓	✓	✓
Reports on Microsoft® Word® program format	✓	✓	✓	✓	✓
2D and 3D annotations		✓	✓	✓	✓
1D annotations		✓	✓	✓	✓
Annotations with LaTeX formatting		✓	✓	✓	✓
VTK format export		✓	✓	✓	✓
6 new color tables		✓	✓	✓	✓
Selections for plotting a subset of the geometry			✓	✓	✓
1D plots with two different quantities on y-axes			✓	✓	✓
Step between solutions using toolbar buttons			✓	✓	✓
3Dconnexion® SpaceMouse® device support			✓	✓	✓
Cividis color table for people with color vision deficiency			✓	✓	✓
Save plots in models for faster rendering			✓	✓	✓
Export animations in the WebM video format			✓	✓	✓
Arrows on streamlines				✓	✓
Evaluation groups				✓	✓
glTF™ file export				✓	✓
Report templates				✓	✓
Animated spheres and arrows on Streamline plots					✓
Link from PowerPoint® to import COMSOL® model images					✓
PLY and 3MF export of plots					✓

Application Builder	4.X	5.0–2	5.3	5.4	5.5
Application Builder for converting models to applications		✓	✓	✓	✓
Send email from applications		✓	✓	✓	✓
60 example applications in the Application Libraries		✓	✓	✓	✓
Interactive data picking in graphics			✓	✓	✓
OS command line arguments				✓	✓
Local declarations and methods in forms				✓	✓
NEW Product: COMSOL Compiler™				✓	✓
Add-ins to COMSOL Multiphysics					✓

See page 18 for more details

COMSOL Server™ Product	4.X	5.0-2	5.3	5.4	5.5
NEW Product: COMSOL Server™		✓	✓	✓	✓
Run applications with COMSOL Client for Windows® operating system or web browsers		✓	✓	✓	✓
Allow coworkers and customers worldwide to run COMSOL applications		✓	✓	✓	✓
Custom COMSOL Server™ themes for branding		✓	✓	✓	✓
Centralized cluster settings			✓	✓	✓
Usage log text file			✓	✓	✓
Automatic login to COMSOL Server™			✓	✓	✓
Live search in the Application Library page				✓	✓
Send notifications to users as email				✓	✓
Updated appearance with new colors					✓
Automatically release licenses when software is idle					✓

See page 19 for more details

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Lumped ports and R,L,C,S parameter matrices	✓	✓	✓	✓	✓
Multiphysics interface for electrostatic-structural interactions	✓	✓	✓	✓	✓
Multiphysics interface for piezoresistivity	✓	✓	✓	✓	✓
Inductively coupled and microwave plasmas	✓	✓	✓	✓	✓
NEW Product: Wave Optics Module	✓	✓	✓	✓	✓
NEW Product: Semiconductor Module	✓	✓	✓	✓	✓
Nonlinear magnetic material library with 165 materials	✓	✓	✓	✓	✓
Multiphysics interface for laser heating	✓	✓	✓	✓	✓
Multiphysics interface for optoelectronics		✓	✓	✓	✓
NEW Product: Ray Optics Module		✓	✓	✓	✓
Coil analysis tools		✓	✓	✓	✓
Optical materials database with over 1400 materials		✓	✓	✓	✓
Multiphysics interface for ray heating		✓	✓	✓	✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
User-defined materials written in C		✓	✓	✓	✓
Smith plots		✓	✓	✓	✓
Magnetic vector hysteresis material model		✓	✓	✓	✓
Optical aberration plots		✓	✓	✓	✓
Electrostatics based on the boundary element method (BEM)			✓	✓	✓
Accelerated computation of capacitance matrix and other lumped matrices			✓	✓	✓
Part Library with waveguides, surface-mount footprints, and SMA connectors			✓	✓	✓
Photometric data file import for ray optics			✓	✓	✓
Schrödinger equation interfaces			✓	✓	✓
Revolutionary new method for capacitively coupled plasma (CCP) simulations			✓	✓	✓
Hybrid boundary-element–finite-element method (BEM-FEM) for magnetic field analysis			✓	✓	✓
Soft magnet material model of permanent magnets			✓	✓	✓
Adaptive frequency sweep for high-frequency electromagnetics			✓	✓	✓
Library of more than 60 RF and microwave substrate materials from Rogers Corporation			✓	✓	✓
Electric currents in layered shells				✓	✓
Part Library for coils and magnetic cores				✓	✓
Far-field analysis for transient models				✓	✓
High-definition Part Library for ray optics				✓	✓
Optical dispersion models for ray optics				✓	✓
New algorithm for computing ray intensity and power				✓	✓
Wavelength distributions at ray releases for polychromatic light				✓	✓
Multiphysics interface for Schrödinger-Poisson Equation				✓	✓
Lorentz coupling multiphysics for electroacoustic transducers					✓
Hard magnetic materials library for permanent magnets					✓
Full-wave and ray optics simulation coupling					✓
Mixed-mode S-parameters					✓
Spot Diagram plot					✓
New interface for detecting electrical breakdown					✓
New tools for corona discharge in electrostatic precipitators					✓
Density-gradient formulation for semiconductor device simulations					✓

See page 20 for more details

HEAT TRANSFER	4.X	5.0–2	5.3	5.4	5.5
Multilayered shells	✓	✓	✓	✓	✓
Fans and grilles	✓	✓	✓	✓	✓
Solar irradiation	✓	✓	✓	✓	✓
Moist air and condensation	✓	✓	✓	✓	✓
Multiwavelength radiation	✓	✓	✓	✓	✓
Phase change	✓	✓	✓	✓	✓
Thermal contact with surface roughness	✓	✓	✓	✓	✓
Multiphysics interface for the thermoelectric effect	✓	✓	✓	✓	✓
Bioheating with damage integral analysis	✓	✓	✓	✓	✓
Nonisothermal flow in porous media		✓	✓	✓	✓
Algebraic turbulence models		✓	✓	✓	✓
Multiphysics interface for the Marangoni effect		✓	✓	✓	✓
Meteorological database for ambient conditions		✓	✓	✓	✓
Multiphysics interface for heat and moisture transport		✓	✓	✓	✓
Surface-to-surface radiation symmetry for perpendicular planes			✓	✓	✓
Irreversible transformations in solids			✓	✓	✓
New Moisture Flow multiphysics coupling			✓	✓	✓
New inflow boundary condition based on known upstream conditions			✓	✓	✓
Beer-Lambert law for absorption of light in weakly absorbing media			✓	✓	✓
Mixed diffuse-specular reflections and semitransparent surfaces				✓	✓
Heat transfer in thin, layered structures				✓	✓
Arbitrary number of spectral bands for surface-to-surface radiation				✓	✓
Light-diffusion equation interface				✓	✓
Thermal insulation for interior boundaries				✓	✓
Ambient Thermal Properties tool				✓	✓
Dedicated plots for temperature discontinuities				✓	✓
NEW Product: Metal Processing Module					✓
Lumped Thermal System interface					✓
Multiple spectral bands for radiation in participating media					✓
Surface-to-Surface radiation with ray shooting method					✓
Multiphysics coupling for heat transfer in thin structures					✓

See page 25 for more details

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Prestressed analysis	✓	✓	✓	✓	✓
Thin-film damping for MEMS	✓	✓	✓	✓	✓
NEW Product: Geomechanics Module	✓	✓	✓	✓	✓
Multiphysics interface for MEMS thermoelasticity	✓	✓	✓	✓	✓
Load cases	✓	✓	✓	✓	✓
Membranes	✓	✓	✓	✓	✓
Cyclic and Floquet periodicity	✓	✓	✓	✓	✓
NEW Product: Nonlinear Structural Materials Module	✓	✓	✓	✓	✓
NEW Product: Fatigue Module	✓	✓	✓	✓	✓
Bolt pretension	✓	✓	✓	✓	✓
NEW Product: Multibody Dynamics Module	✓	✓	✓	✓	✓
Rotordynamic forces	✓	✓	✓	✓	✓
Multiphysics interface for hygroscopic swelling		✓	✓	✓	✓
Nonlinear elastic materials		✓	✓	✓	✓
Orthotropic, anisotropic, and hyperelastic membranes		✓	✓	✓	✓
Multiphysics interfaces for multibody dynamics with heat transfer and acoustics		✓	✓	✓	✓
NEW Product: Rotordynamics Module		✓	✓	✓	✓
Multiphysics interface for thermoelastic damping in MEMS		✓	✓	✓	✓
User-defined materials written in C		✓	✓	✓	✓
Adhesion and decohesion for mechanical contact		✓	✓	✓	✓
Multiphysics interface for magnetostriction		✓	✓	✓	✓
New plasticity material models		✓	✓	✓	✓
Stress linearization evaluation of membrane, bending, and peak stress			✓	✓	✓
Automatic suppression of rigid body motion			✓	✓	✓
Computation of safety factors for 12 safety criteria			✓	✓	✓
Frequency response of mechanical contact models			✓	✓	✓
Material models for porous plasticity			✓	✓	✓
Vibration fatigue analysis			✓	✓	✓
Rotor bearing system simulator application			✓	✓	✓
Shape memory alloy (SMA) material models			✓	✓	✓
Generalized multiphysics interface for fluid-structure interaction (FSI)			✓	✓	✓
Bolt thread contact modeling			✓	✓	✓
Solid-beam connection in 3D models			✓	✓	✓
Generalized plane strain formulation			✓	✓	✓
Cam-Follower condition for multibody dynamics			✓	✓	✓
Lumped Mechanical System interface			✓	✓	✓
Ball and roller bearings for rotordynamics simulations			✓	✓	✓
NEW Product: Composite Materials Module				✓	✓
Composite material analysis based on layerwise and equivalent single layer theory				✓	✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Response spectrum analysis				✓	✓
Representative volume elements (RVE) for homogenization of periodic materials				✓	✓
Shell interface for axisymmetric analysis				✓	✓
Multiphysics interface for fluid-structure interaction with shells , membranes, and composite materials				✓	✓
Multiphysics interface for fluid-structure interaction with structural assemblies and multibody dynamics				✓	✓
Multiphysics interface for acoustic-structure interaction for composite materials				✓	✓
Multiphysics interface for thermal expansion in composite materials				✓	✓
Multiphysics interface for Joule heating in composite materials				✓	✓
Multiphysics interface for thermoelectric effect in composite materials				✓	✓
Activation of material for additive manufacturing				✓	✓
Flexible formulation for rigid connectors and attachments				✓	✓
Mullins effect for hyperelastic materials				✓	✓
Continuum-based damage model for brittle materials				✓	✓
New modeling options for hyperelastic materials with low compressibility				✓	✓
Mean stress correction for fatigue analysis based on the Goodman, Gerber, and Soderberg methods				✓	✓
Multiphysics interface for electromechanics with structural FEM and electrostatics BEM				✓	✓
Multibody Dynamics Module an add-on to COMSOL Multiphysics					✓
Contact modeling extended to Shell, Layered Shell, and Membrane interfaces					✓
Random vibration analysis					✓
Nonlinear materials in Shell and Layered Shell interfaces					✓
Multiphysics interface for FSI with heat transfer					✓
FSI for two-phase flow					✓
Mechanical analysis of pipes					✓
Piezoelectric material in layered shells					✓
Roller chain sprocket modeling					✓
Automatic setup of rigid domains and gears					✓

See page 27 for more details

ACOUSTICS	4.X	5.0–2	5.3	5.4	5.45
Multiphysics interface for acoustic-piezo interactions	✓	✓	✓	✓	✓
Multiphysics interface for acoustic-shell interactions	✓	✓	✓	✓	✓
Multiphysics interface for poroelastic waves	✓	✓	✓	✓	✓
Multiphysics interface for thermoviscous acoustic-solid interactions	✓	✓	✓	✓	✓
Multiphysics interface for pipe acoustics	✓	✓	✓	✓	✓
Multiphysics interface for membrane-acoustic interactions	✓	✓	✓	✓	✓
Multiphysics interface for thermoviscous acoustic-shell interactions	✓	✓	✓	✓	✓
Aeroacoustics with linearized Euler equations	✓	✓	✓	✓	✓
Ray acoustics		✓	✓	✓	✓

ACOUSTICS	4.X	5.0–2	5.3	5.4	5.45
Aeroacoustics with linearized Navier-Stokes equations		✓	✓	✓	✓
Octave plots		✓	✓	✓	✓
Discontinuous Galerkin method for ultrasound with background flow		✓	✓	✓	✓
Directivity plots		✓	✓	✓	✓
Perfectly matched layers (PMLs) for pressure acoustics in the time domain			✓	✓	✓
Beam width calculations for far-field plots			✓	✓	✓
Thermoviscous acoustics in the time domain			✓	✓	✓
Hybrid BEM-FEM for acoustics and acoustic-structure interactions			✓	✓	✓
Impulse response analysis for ray acoustics			✓	✓	✓
Port boundary conditions for pressure acoustics				✓	✓
Nonlinear acoustics Westervelt model for high sound pressure levels				✓	✓
Atmosphere and ocean attenuation material models				✓	✓
Multiphysics BEM-FEM coupling to thermoviscous acoustics and poroelastic waves				✓	✓
Multiphysics BEM-FEM coupling to poroelastic waves				✓	✓
New Elastic Waves, Time Explicit interface					✓
Acoustic-structure interaction for time explicit interfaces					✓
Ports for thermoviscous acoustics					✓
Background fluid flow coupling and mapping study for aeroacoustics					✓
New solvers for large frequency-domain acoustic problems					✓
Acoustic-Pipe Acoustic Connection multiphysics coupling					✓

See page 32 for more details

FLUID FLOW	4.X	5.0–2	5.3	5.4	5.5
High Mach number flow	✓	✓	✓	✓	✓
NEW Product: Microfluidics Module	✓	✓	✓	✓	✓
k-omega turbulence model	✓	✓	✓	✓	✓
Euler-Euler two-phase flow	✓	✓	✓	✓	✓
Slip flow	✓	✓	✓	✓	✓
NEW Product: Pipe Flow Module	✓	✓	✓	✓	✓
Automatic boundary layer meshing	✓	✓	✓	✓	✓
Turbulent mixing and reacting flow	✓	✓	✓	✓	✓
SST turbulence	✓	✓	✓	✓	✓
Thin screens	✓	✓	✓	✓	✓
NEW Product: Molecular Flow Module	✓	✓	✓	✓	✓
Wall surface roughness for turbulent flow	✓	✓	✓	✓	✓
Anisotropic porous media flow	✓	✓	✓	✓	✓
NEW Product: Mixer Module	✓	✓	✓	✓	✓
Algebraic turbulence models		✓	✓	✓	✓
Turbulence with grilles and fans		✓	✓	✓	✓

FLUID FLOW	4.X	5.0–2	5.3	5.4	5.5
Cavitation for thin film flow		✓	✓	✓	✓
3D laminar flow to 1D pipe flow connection		✓	✓	✓	✓
Coupled porous media and turbulent flow		✓	✓	✓	✓
Three-phase laminar flow		✓	✓	✓	✓
Easy definition of gravity and buoyancy effects		✓	✓	✓	✓
v2-f turbulence model			✓	✓	✓
Automatic wall treatment for turbulent flow			✓	✓	✓
Algebraic multigrid (AMG) solver for CFD			✓	✓	✓
Transport of diluted species in porous media and fractures			✓	✓	✓
Generalized multiphysics interface for fluid-structure interaction (FSI)			✓	✓	✓
Inlet boundary conditions for fully developed turbulent flow			✓	✓	✓
Realizable k-ε turbulence model			✓	✓	✓
Buoyancy-driven turbulence			✓	✓	✓
All turbulence models made available for multiphase flow			✓	✓	✓
Rotating machinery interfaces made available for all flow interfaces			✓	✓	✓
Large eddy simulation (LES) for single-phase flow				✓	✓
Phase transport in free and porous media				✓	✓
Fully developed flow at inlets and outlets for turbulent flow				✓	✓
Non-Newtonian yield-stress fluids: Bingham-Papanastasiou, Casson-Papanastasiou models, amd Herschel-Bulkley-Papanastasiou				✓	✓
NEW Product: Porous Media Flow Module					✓
Viscoelastic flow					✓
Compressible Euler equations					✓
Phase transport mixture model for arbitrary number of dispersed phases					✓
Nonisothermal large eddy simulation (LES)					✓
Continuity and Initial Interface pair features					✓
Inelastic non-Newtonian constitutive relations					✓
Interior Slip Wall feature					✓
Reacting flow in porous media					✓
Heat transfer in fractures					✓
Non-Darcian flow					✓
Mechanical analysis of pipes					✓

See page 34 for more details

CHEMICAL	4.X	5.0–2	5.3	5.4	5.5
Surface reactions	✓	✓	✓	✓	✓
Reacting flow	✓	✓	✓	✓	✓
AC impedance spectroscopy	✓	✓	✓	✓	✓
NEW Product: Electrodeposition Module	✓	✓	✓	✓	✓
NEW Product: Corrosion Module	✓	✓	✓	✓	✓
NEW Product: Electrochemistry Module	✓	✓	✓	✓	✓
Multiscale simulations for packed bed reactors		✓	✓	✓	✓
Equilibrium reactions		✓	✓	✓	✓
Multiphysics interface for hygroscopic swelling with species transport		✓	✓	✓	✓
Nonspherical catalytic pellet shapes		✓	✓	✓	✓
Thin insulating sheets for corrosion simulations		✓	✓	✓	✓
Nernst-Planck-Poisson equations interface			✓	✓	✓
Electrophoretic transport interface			✓	✓	✓
Primary and secondary current distribution based on the boundary element method (BEM)			✓	✓	✓
A built-in thermodynamic properties library			✓	✓	✓
Link between Reaction Engineering interface and thermodynamic property packages			✓	✓	✓
Electrode reactions on thin electrode surfaces fully immersed in electrolyte			✓	✓	✓
New Lithium-Ion Battery Designer application for optimizing batteries for specific use cases			✓	✓	✓
Updated Thermodynamics interface				✓	✓
Partition condition for prescribing the ratio between concentrations in two adjacent phases				✓	✓
Lumped battery interface				✓	✓
Stress and strain in electrode particles due to lithium intercalation				✓	✓
Equivalent circuit modeling of batteries				✓	✓
Level set interface for corrosion modeling				✓	✓
Generate materials from a thermodynamic system					✓
Generate a Chemistry interface from a thermodynamic system					✓
Diffusivity models for gases and liquids					✓
Water and steam properties					✓
Single-ion conductor charge balance for solid-state batteries					✓
Lumped Battery interface improvements					✓
Equilibrium potential calculation using the Nernst Equation					✓
Concentration-dependent Butler-Volmer kinetics					✓
Electrode reactions for Batteries & Fuel Cells					✓
Current Distribution, Pipe interface					✓

See page 36 for more details

OPTIMIZATION	4.X	5.0–2	5.3	5.4	5.5
Parameter optimization	✓	✓	✓	✓	✓
Design optimization	✓	✓	✓	✓	✓
Gradient-based and derivative-free optimization study	✓	✓	✓	✓	✓
Multianalysis optimization		✓	✓	✓	✓
New least square fitting method		✓	✓	✓	✓
Density model feature for topology optimization				✓	✓
Combined parametric sweeps with derivative-free optimization				✓	✓
Easier shape optimization setup					✓
Filter dataset for creating smooth topology optimization mesh					✓
Compute confidence intervals for parameter estimation					✓

See page 38 for more details

PARTICLE TRACING	4.X	5.0–2	5.3	5.4	5.5
NEW Product: Particle Tracing Module	✓	✓	✓	✓	✓
Secondary emission	✓	✓	✓	✓	✓
Particle-particle interactions	✓	✓	✓	✓	✓
Particle-field and fluid-particle interactions	✓	✓	✓	✓	✓
Space-charge limited emission		✓	✓	✓	✓
Particle-matter interactions		✓	✓	✓	✓
Periodic boundary condition for particle tracing			✓	✓	✓
Rotating frames for particle tracing			✓	✓	✓
Symmetry boundary condition for particle tracing			✓	✓	✓
Accumulators for velocity reinitialization to compute, for example, spatial density of collisions				✓	✓
Faster particle tracing with coupled fields					✓
Virtual mass and pressure gradient forces					✓
Particle size distributions					✓
Particle charging for fluid flow					✓
New tools for corona discharge in electrostatic precipitators					✓

See page 39 for more details

INTERFACING	4.X	5.0–2	5.3	5.4	5.5
NEW Product: LiveLink™ *for* AutoCAD®	✓	✓	✓	✓	✓
LiveLink™ *for* SOLIDWORKS®: one-window interface	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* PTC® Creo® Parametric™	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Excel®	✓	✓	✓	✓	✓
NEW Product: ECAD Import Module	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Solid Edge®	✓	✓	✓	✓	✓
LiveLink™ *for* Inventor®: one-window interface	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Revit®	✓	✓	✓	✓	✓
NEW Product: Design Module	✓	✓	✓	✓	✓

See page 41 for more details

COMSOL® Software – Release Details History

COMSOL MULTIPHYSICS® PLATFORM AND HARDWARE SUPPORT	4.X	5.0–2	5.3	5.4	5.5
General Windows® and Linux® operating systems and macOS support	✓	✓	✓	✓	✓
Run applications on all major web browsers		✓	✓	✓	✓
macOS 10.10–10.14 Sierra operating system support		✓	✓	✓	✓
Windows® 10 operating system support		✓	✓	✓	✓
3Dconnexion® SpaceMouse® device support			✓	✓	✓
NEW Product: COMSOL Compiler™				✓	✓
Compile applications to smaller executable files					✓

COMSOL MULTIPHYSICS® MESH AND GEOMETRY	4.X	5.0–2	5.3	5.4	5.5
Virtual geometry operations	✓	✓	✓	✓	✓
Parametric surfaces	✓	✓	✓	✓	✓
Digital elevation model (DEM) import	✓	✓	✓	✓	✓
Image import	✓	✓	✓	✓	✓
Interpolation curves	✓	✓	✓	✓	✓
STL export	✓	✓	✓	✓	✓
3D cross-section work planes	✓	✓	✓	✓	✓
Automatic curvilinear coordinate systems	✓	✓	✓	✓	✓
Boolean operations on surfaces	✓	✓	✓	✓	✓
NASTRAN® program import	✓	✓	✓	✓	✓
NASTRAN® program mesh export	✓	✓	✓	✓	✓
Solid operations on imported meshes		✓	✓	✓	✓
Loft, fillet, chamfer, thickening, and midsurfacing with the new Design Module		✓	✓	✓	✓
Geometry parts		✓	✓	✓	✓
New tetrahedral mesher		✓	✓	✓	✓
Mesh parts		✓	✓	✓	✓
Element quality optimizer		✓	✓	✓	✓
STL import with multiple solids		✓	✓	✓	✓
Performance improvements for large models by a factor of 5 or more			✓	✓	✓
Coordinate systems defined by work planes and geometry orientations			✓	✓	✓
Combined coordinate systems in physics			✓	✓	✓
Automatic removal of geometric detail for more flexible meshing			✓	✓	✓
Extrude in two directions			✓	✓	✓
Line segment tool			✓	✓	✓
2D selections from 3D selections using cross sections			✓	✓	✓
Geometry part variants			✓	✓	✓
Automatic pyramid transitions from hex to tet elements			✓	✓	✓
Mesh size expressions			✓	✓	✓

See pages 1-12 for Release Highlights

COMSOL MULTIPHYSICS® MESH AND GEOMETRY	4.X	5.0–2	5.3	5.4	5.5
Mesh adaptation integrated with mesh sequence			✓	✓	✓
Five new mesh quality measures			✓	✓	✓
Automatic detection of straight and planar edges of imported meshes			✓	✓	✓
Option for switching off mesh rendering			✓	✓	✓
Projection coupling operators for all element types			✓	✓	✓
Parametric models with user-defined functions			✓	✓	✓
Automatic removal of thin domains for more flexible meshing			✓	✓	✓
Element size expressions based on physics and materials			✓	✓	✓
Selections stored in the COMSOL mesh file format (.mphbin and .mphtxt)			✓	✓	✓
Isolated vertices and edges for mapped meshes			✓	✓	✓
Mesh refinement for all element types				✓	✓
Collapse narrow face regions for easier meshing				✓	✓
Selection-based automatic removal of geometric detail				✓	✓
Extended mesh adaption with element coarsening and mesh modifications				✓	✓
Physics-controlled meshing controlled per physics interface				✓	✓
Swept meshing of domains with isolated vertices and edges				✓	✓
Convert, Refine, and Adapt operations for imported meshes				✓	✓
Faster boundary-layer meshing				✓	✓
Sketching tools in 2D and 3D work planes					✓
Dimensions and constraints tools with the Design Module					✓
Associative geometry import					✓
Selections from materials, layers, and colors					✓
Delete holes defeaturing operation					✓
Rigid Transform operation					✓
New geometry parts in the Part Libraries					✓
Automatic removal of narrow face regions					✓
Direct meshing of imported surface meshes					✓
Create meshes from Filter datasets					✓
Import and export 3MF and PLY file formats					✓
Robust generation of curved elements					✓

COMSOL MULTIPHYSICS® MODELING TOOLS	4.X	5.0–2	5.3	5.4	5.5
Coordinate-based selections	✓	✓	✓	✓	✓
Boundary PDEs and distributed ODEs	✓	✓	✓	✓	✓
New COMSOL Desktop®	✓	✓	✓	✓	✓
Multiphysics node in the Model Builder	✓	✓	✓	✓	✓
Hover-and-click selections	✓	✓	✓	✓	✓
Global materials		✓	✓	✓	✓
Material sweeps		✓	✓	✓	✓

COMSOL MULTIPHYSICS® MODELING TOOLS	4.X	5.0–2	5.3	5.4	5.5
Open and inspect MPH-files without add-on licenses		✓	✓	✓	✓
Search tool for models and applications		✓	✓	✓	✓
Table sort		✓	✓	✓	✓
Save MPH-file if license server connection is lost		✓	✓	✓	✓
Release licenses dynamically		✓	✓	✓	✓
Autocomplete for parameters, variables, and equations		✓	✓	✓	✓
Automatic reconnect for client-server		✓	✓	✓	✓
Optimized save for MPH-files		✓	✓	✓	✓
Multiphysics window for manually combining physics interfaces		✓	✓	✓	✓
Generalized 3D interpolation functions		✓	✓	✓	✓
Cylindrical sector selections			✓	✓	✓
Model methods for programming Model Builder tasks			✓	✓	✓
Faster save and load of MPH-files			✓	✓	✓
PDE modeling with the boundary element method (BEM)			✓	✓	✓
Copy-paste physics interfaces or model components			✓	✓	✓
Model methods in the model tree with input arguments			✓	✓	✓
Generalized moving mesh functionality			✓	✓	✓
Variables for matrix operations			✓	✓	✓
Application for cluster setup validation			✓	✓	✓
Counter for the number of selections			✓	✓	✓
Colored selections for geometry and physics				✓	✓
Multiple Parameter nodes				✓	✓
Parameter Cases				✓	✓
Node groups for organizing the model tree				✓	✓
Model and application comparison				✓	✓
Import and export of preferences				✓	✓
Multiselection in Parameters and Variables tables				✓	✓
Custom Settings windows				✓	✓
Use select box, deselect box, and zoom box multiple times					✓
Automatically release licenses when software is idle					✓
Context menu available in the Graphics window					✓
Modify the Graphics window toolbar display					✓
Advanced options dialog window					✓
Copy-Paste functionality extended to additional features					✓
Add-Ins to COMSOL Multiphysics					✓
Application Libraries preview option					✓

COMSOL MULTIPHYSICS® STUDIES AND SOLVERS	4.X	5.0–2	5.3	5.4	5.45
Time-dependent adaptive meshing	✓	✓	✓	✓	✓
Automatic remeshing	✓	✓	✓	✓	✓
Double dogleg nonlinear solver	✓	✓	✓	✓	✓
Cluster Sweep and Batch Sweep	✓	✓	✓	✓	✓
Multiparameter sweeps	✓	✓	✓	✓	✓
Cloud computing with Amazon EC2™	✓	✓	✓	✓	✓
Sensitivity study	✓	✓	✓	✓	✓
CAD assembly multiphysics simulations		✓	✓	✓	✓
Eigenfrequency interval search		✓	✓	✓	✓
Selections for solution data		✓	✓	✓	✓
Smoothed AMG solver		✓	✓	✓	✓
Optimized domain decomposition solver		✓	✓	✓	✓
Nonreflecting absorbing layers for time-dependent wave simulations		✓	✓	✓	✓
Specify the number of sockets used on a multisocket computer		✓	✓	✓	✓
Algebraic multigrid (AMG) solver for CFD			✓	✓	✓
Adaptation integrated with meshing sequences and error estimation			✓	✓	✓
Fast solver for the boundary element method (BEM)			✓	✓	✓
Hybrid solver for finite element and boundary element methods			✓	✓	✓
Combine two solutions into one			✓	✓	✓
Direct and iterative solver suggestions			✓	✓	✓
Model reduction based on modal analysis and asymptotic waveform evaluation (AWE)			✓	✓	✓
Parallelized smoothed aggregation algebraic multigrid (SA-AMG) solver			✓	✓	✓
Remove selections when combining solutions			✓	✓	✓
Compute weighted sums of solutions			✓	✓	✓
Auxiliary parameter sweeps for eigenfrequency and eigenvalue studies			✓	✓	✓
Starting UI-defined Batch Sweep or Cluster Sweep from a batch command			✓	✓	✓
Built-in support for PBS-based schedulers in cluster computing			✓	✓	✓
Several times faster solving in the Windows® operating system				✓	✓
Parameter sweeps over Parameter Cases				✓	✓
Optimization for parametric sweeps with derivative-free methods				✓	✓
Mesh refinement level parameter for adaptive meshing				✓	✓
New TFQMR iterative linear solver				✓	✓
Distributed solution data storage on clusters					✓
Smoothing operations for multigrid solvers improved on clusters					✓
More efficient discontinuous Galerkin method					✓
Limiters for the discontinuous Galerkin method					✓
New Schur solver for domain decomposition					✓

COMSOL MULTIPHYSICS® STUDIES AND SOLVERS	4.X	5.0–2	5.3	5.4	5.45
Goal-oriented mesh adaptation					✓
Adaptive mesh refinement on geometry subsets					✓
Blocked low-rank factorization for MUMPS solver					✓
Two new Batch mode options for logging and clearing solutions					✓

COMSOL MULTIPHYSICS® RESULTS AND VISUALIZATION	4.X	5.0–2	5.3	5.4	5.5
Report Generator	✓	✓	✓	✓	✓
Interactive slice and isosurface plots	✓	✓	✓	✓	✓
Join data sets	✓	✓	✓	✓	✓
Reports on Microsoft® Word® program format	✓	✓	✓	✓	✓
Comet tail plots	✓	✓	✓	✓	✓
STL export of isosurfaces	✓	✓	✓	✓	✓
Text-based search for variables in results	✓	✓	✓	✓	✓
Spectrum color table		✓	✓	✓	✓
Contour tube plot		✓	✓	✓	✓
Visualize on grid outside computational mesh		✓	✓	✓	✓
Point trajectories plot		✓	✓	✓	✓
Array visualization for periodic solutions		✓	✓	✓	✓
2D and 3D annotations		✓	✓	✓	✓
1D annotations		✓	✓	✓	✓
Annotations with LaTeX formatting		✓	✓	✓	✓
VTK format export		✓	✓	✓	✓
6 new color tables		✓	✓	✓	✓
Multiple expressions in Derived Values		✓	✓	✓	✓
Results parameters		✓	✓	✓	✓
Global expressions for Slice, Arrow, and Cut Plane positions		✓	✓	✓	✓
Selections for plotting a subset of the geometry			✓	✓	✓
1D plots with two different quantities on y-axes			✓	✓	✓
Step between solutions using toolbar buttons			✓	✓	✓
Streamline surface plot			✓	✓	✓
Units shown in geometry plots and color legends			✓	✓	✓
Option for switching off mesh rendering			✓	✓	✓
Preview evaluation plane for far-field and directivity plots			✓	✓	✓
Cividis color table for people with color vision deficiency			✓	✓	✓
Save plots in models for faster rendering			✓	✓	✓
Export animations in the WebM video format			✓	✓	✓
Interactive control of center of rotation			✓	✓	✓
Rotating the camera about the x-, y-, and z-axes			✓	✓	✓

COMSOL MULTIPHYSICS® RESULTS AND VISUALIZATION	4.X	5.0–2	5.3	5.4	5.5
Filters on 1D plots			✓	✓	✓
Plot First and Plot Last buttons			✓	✓	✓
Hardware-accelerated image generation for image export			✓	✓	✓
Arrows on streamlines				✓	✓
Evaluation groups				✓	✓
Report templates				✓	✓
Extrusion data sets				✓	✓
Surface slit plots for visualizing discontinuous fields				✓	✓
glTF™ file export				✓	✓
API functionality for custom plots				✓	✓
New Graphics toolbar buttons				✓	✓
Faster rendering for large plots				✓	✓
New lighting model with improved quality of 3D plots with Scene Light				✓	✓
Spheres and arrows that move in Streamline plots					✓
Filter dataset					✓
Image export includes more model workflow Graphics					✓
Link from PowerPoint® to import COMSOL® model images					✓
Specify selections for entire plot groups					✓
Toolbar buttons to step through expressions					✓
Transpose results in evaluation groups					✓
Gradient coloring option between two colors					✓
PLY and 3MF export of plots					✓

COMSOL MULTIPHYSICS® APPLICATION BUILDER	4.X	5.0–2	5.3	5.4	5.5
Application Builder		✓	✓	✓	✓
Convert model to application		✓	✓	✓	✓
20 example applications in Application Libraries		✓	✓	✓	✓
Send email from applications		✓	✓	✓	✓
Support for applications using LiveLink™ *for* Excel®		✓	✓	✓	✓
Enabling disabling of form objects from methods		✓	✓	✓	✓
60 example applications in Application Libraries		✓	✓	✓	✓
Editor tools		✓	✓	✓	✓
Dynamic graphics updates		✓	✓	✓	✓
Modifying the user interface at runtime		✓	✓	✓	✓
Autocompletion for application objects		✓	✓	✓	✓
Video and hyperlink form objects		✓	✓	✓	✓
Unit sets for centralized unit control		✓	✓	✓	✓
Interactive data picking in graphics			✓	✓	✓

COMSOL MULTIPHYSICS® APPLICATION BUILDER	4.X	5.0–2	5.3	5.4	5.5
Data access in the Application Builder settings			✓	✓	✓
Improved toolbar for applications in a web browser			✓	✓	✓
Data access for physics interfaces			✓	✓	✓
Horizontal radio buttons			✓	✓	✓
OS command line arguments				✓	✓
Flat-style buttons				✓	✓
Local declarations and methods in forms				✓	✓
Unified model methods and application methods				✓	✓
Specify toolbar groups in Graphics form object					✓
New clearDebugLog method					✓
File declarations in command line arguments					✓

COMSOL SERVER™	4.X	5.0–2	5.3	5.4	5.5
NEW Product: COMSOL Server™		✓	✓	✓	✓
Run applications with COMSOL Client for Windows®		✓	✓	✓	✓
Run applications with any major web browser		✓	✓	✓	✓
Allow coworkers and customers to run COMSOL applications		✓	✓	✓	✓
Fast launch of applications, application prelaunching		✓	✓	✓	✓
Configure for one application		✓	✓	✓	✓
Reconnect to application for lost connections		✓	✓	✓	✓
Custom COMSOL Server™ themes for branding		✓	✓	✓	✓
Power user role for user accounts		✓	✓	✓	✓
Centralized cluster settings			✓	✓	✓
Servers and Sessions view in the Monitor page			✓	✓	✓
Automatic migration of preferences from previous installations			✓	✓	✓
Usage log text file			✓	✓	✓
Reverse proxy support			✓	✓	✓
COMSOL Client login with Windows® Authentication, Active Directory®, or LDAP			✓	✓	✓
Current license and product usage display			✓	✓	✓
Upload multiple applications at the same time			✓	✓	✓
Automatic login to COMSOL Server™			✓	✓	✓
Edit description and thumbnail image in the COMSOL Server™ web interface			✓	✓	✓
Modify and test login configuration in the COMSOL Server™ web interface			✓	✓	✓
Anonymous user login			✓	✓	✓
Import and export preferences			✓	✓	✓
Send notifications to users			✓	✓	✓
Custom license error messages			✓	✓	✓
Run in COMSOL Client for automatically logged-in users				✓	✓

COMSOL SERVER™	4.X	5.0–2	5.3	5.4	5.5
Live search in the Application Library page				✓	✓
Send notifications to users as email				✓	✓
Updated appearance with new colors					✓
Automatically release licenses when software is idle					✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Lumped ports and matrices for AC/DC	✓	✓	✓	✓	✓
Far fields in dielectric media	✓	✓	✓	✓	✓
S-parameter matrices for high-frequency electromagnetics	✓	✓	✓	✓	✓
Differential inductance	✓	✓	✓	✓	✓
Multiphysics interface electrostatic-structural interactions	✓	✓	✓	✓	✓
Coil excitation tools	✓	✓	✓	✓	✓
Porous media material models	✓	✓	✓	✓	✓
Electrical motors and generator tools	✓	✓	✓	✓	✓
Dispersive media	✓	✓	✓	✓	✓
Multiphysics interface for piezoresistivity	✓	✓	✓	✓	✓
S-parameter matrices for low-frequency electromagnetics	✓	✓	✓	✓	✓
Inductively coupled plasmas	✓	✓	✓	✓	✓
Periodic ports with Floquet periodicity	✓	✓	✓	✓	✓
Lumped RLC elements	✓	✓	✓	✓	✓
NEW Product: Wave Optics Module	✓	✓	✓	✓	✓
New E-J formulation for superconductive materials	✓	✓	✓	✓	✓
Vectorized floating potentials	✓	✓	✓	✓	✓
Electrical contact with surface roughness	✓	✓	✓	✓	✓
NEW Product: Semiconductor Module	✓	✓	✓	✓	✓
Nonlinear magnetic material library with 165 materials	✓	✓	✓	✓	✓
Improved multiphysics interface for induction heating	✓	✓	✓	✓	✓
Interior ports	✓	✓	✓	✓	✓
Transition boundary condition for thin conductive films	✓	✓	✓	✓	✓
Deposited microwave power boundary condition	✓	✓	✓	✓	✓
Gaussian background field	✓	✓	✓	✓	✓
Improved multiphysics interface for microwave heating	✓	✓	✓	✓	✓
Multiphysics interface for laser heating	✓	✓	✓	✓	✓
Improved multiphysics interface for Joule heating	✓	✓	✓	✓	✓
Thermal diffusion of electrons in plasmas	✓	✓	✓	✓	✓
Heterojunctions, impact ionization, and field-dependent mobility	✓	✓	✓	✓	✓
Small-signal analysis and incomplete ionization for semiconductors	✓	✓	✓	✓	✓
Automated meshing for infinite elements and perfectly matched layers		✓	✓	✓	✓
Automatic mesh adaption based on material properties		✓	✓	✓	✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Numeric TEM ports for transmission lines		✓	✓	✓	✓
Multiphysics interface for optoelectronics		✓	✓	✓	✓
Linearly polarized wave as background field		✓	✓	✓	✓
NEW Product: Ray Optics Module		✓	✓	✓	✓
Equilibrium discharges for plasmas		✓	✓	✓	✓
Doping models for semiconductors		✓	✓	✓	✓
Automatic meshing for dopant concentration gradients		✓	✓	✓	✓
Spontaneous emission		✓	✓	✓	✓
Light absorption and stimulated emission		✓	✓	✓	✓
Tunnel currents		✓	✓	✓	✓
Modeling of traps		✓	✓	✓	✓
Band gap narrowing models		✓	✓	✓	✓
Transmission line calculator application		✓	✓	✓	✓
Coil geometry analysis tool		✓	✓	✓	✓
SPICE export		✓	✓	✓	✓
SPICE components: PNP BJT, p-channel MOSFET, Mutual inductance, Transformer		✓	✓	✓	✓
Loss tangent, loss angle, and dissipation factor		✓	✓	✓	✓
Surface roughness on lossy conductive surfaces		✓	✓	✓	✓
Time-domain modeling of dispersive Drude-Lorentz media		✓	✓	✓	✓
Wavelength-domain study		✓	✓	✓	✓
Hexagonal periodic structures		✓	✓	✓	✓
Beam envelope method for ring resonators		✓	✓	✓	✓
Optical materials database with over 1400 materials		✓	✓	✓	✓
Optical components Part Library		✓	✓	✓	✓
Polarization ellipses plot		✓	✓	✓	✓
Multiphysics interface for ray heating		✓	✓	✓	✓
Ray release based on text file		✓	✓	✓	✓
Ray intensity computation in graded media		✓	✓	✓	✓
Material models from externally programmed libraries written in C		✓	✓	✓	✓
Effective nonlinear magnetic curves calculator		✓	✓	✓	✓
Smith plots		✓	✓	✓	✓
Optical fiber simulation application		✓	✓	✓	✓
Multiphysics interface for thermoelastic damping in MEMS		✓	✓	✓	✓
Vector hysteresis with the Jiles-Atherton material model		✓	✓	✓	✓
Magnetic shielding with saturation effects		✓	✓	✓	✓
Boundary surface current coils		✓	✓	✓	✓
Domain terminal boundary condition for electrostatics and electric currents		✓	✓	✓	✓
Mutual capacitance matrix export		✓	✓	✓	✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Improved asymptotic waveform evaluation and frequency-domain modal methods		✓	✓	✓	✓
Two-port networks		✓	✓	✓	✓
Polarization domain for nonlinear frequency mixing		✓	✓	✓	✓
Optical ray propagation outside CAD geometry		✓	✓	✓	✓
Optical aberration plots		✓	✓	✓	✓
Electrostatics based on the boundary element method (BEM)			✓	✓	✓
Hybrid boundary-element--finite-element method (BEM-FEM) for electrostatics			✓	✓	✓
Accelerated computation of capacitance matrix and other lumped matrices			✓	✓	✓
Part library with waveguides, surface-mount footprints, and SMA connectors			✓	✓	✓
Composite lumped LC and RLC elements			✓	✓	✓
Touchstone file import for two-port network boundary condition			✓	✓	✓
Surface magnetic current density boundary condition			✓	✓	✓
Transient S-parameters for time-domain analysis			✓	✓	✓
New postprocessing variables for effective isotropic radiated power and gains			✓	✓	✓
Ray termination based on bounding box, intensity, or power			✓	✓	✓
Photometric data file import for ray optics			✓	✓	✓
Part variants for optical components			✓	✓	✓
Emission according to Lambert's cosine law			✓	✓	✓
Ray detector feature for selecting a subset of rays			✓	✓	✓
Global modeling for initial analyses of plasma processes			✓	✓	✓
Local field approximation for mean electron energy in plasmas			✓	✓	✓
Automatic calculation of electron mobility for plasma simulations			✓	✓	✓
Schrödinger equation interfaces			✓	✓	✓
Current-driven metal contacts for semiconductor device simulations			✓	✓	✓
Revolutionary new method for capacitively coupled plasma (CCP) simulations			✓	✓	✓
Computation of ion energy distribution function (IEDF) and ion angular energy distribution function (IAEDF)			✓	✓	✓
Hybrid boundary-element–finite-element method (BEM-FEM) for magnetostatics			✓	✓	✓
Soft magnet material model for permanent magnets			✓	✓	✓
Adaptive frequency sweep for high-frequency electromagnetics			✓	✓	✓
Updated Electromagnetic Heating multiphysics coupling			✓	✓	✓
Library of more than 60 RF and microwave substrate materials from Rogers Corporation			✓	✓	✓
Generalized rotating machinery interface for magnetics			✓	✓	✓
Edge launch connectors added to the RF Part Library			✓	✓	✓
Deembedded ports			✓	✓	✓
Physics-controlled mesh for frequency-dependent materials			✓	✓	✓
Gaussian beam background field based on plane-wave expansion			✓	✓	✓
Grid-based release of optical rays with cylindrical and hexapolar coordinates			✓	✓	✓
Suppression of reflected rays during refraction			✓	✓	✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Termination based on the number of reflections			✓	✓	✓
New parts for ray optics: Spherical General Lens, Circular Planar Annulus, On Axis Conic Mirror, Off Axis Conic Mirror			✓	✓	✓
Semiconductor equilibrium study			✓	✓	✓
Quasi-fermi-level formulation for semiconductor device simulations			✓	✓	✓
Power-driven terminal condition for semiconductor device simulations			✓	✓	✓
Perfectly matched layers for Schrödinger equation analysis			✓	✓	✓
Electric currents in layered shells				✓	✓
Part Library for coils and magnetic cores				✓	✓
Force computations for nonlinear materials using virtual work				✓	✓
Uniform antenna array factor function				✓	✓
Library of more than 100 RF and microwave substrate materials				✓	✓
3D RCS calculations from 2D axisymmetric models				✓	✓
Electrically thick layer boundary condition for interior boundaries				✓	✓
Time-domain bandpass impulse response via FFT				✓	✓
Far-field analysis for transient models				✓	✓
Circularly polarized background field for 2D axisymmetry				✓	✓
In- and outport direction arrows				✓	✓
Numeric TEM ports with voltage drop direction				✓	✓
One-way coupled multiphysics options in the Model Wizard				✓	✓
Transition and impedance boundary condition for the beam envelope method interfaces				✓	✓
Ports on interior boundaries for the beam envelope method interfaces				✓	✓
Fully anisotropic refractive index tensor				✓	✓
High-definition Part Library for ray optics				✓	✓
Optical dispersion models for ray optics				✓	✓
New algorithm for computing ray intensity and power				✓	✓
Wavelength distributions at ray releases for polychromatic light				✓	✓
Global modeling of non-Maxwellian discharges				✓	✓
New Boltzmann Equation, Two-Term Approximation interface				✓	✓
Pulsed electrical excitation for capacitively coupled plasmas				✓	✓
Species Group feature for the Plasma, Time Periodic interface				✓	✓
Multiphysics interface for the Schrödinger-Poisson Equation				✓	✓
Trap-assisted surface recombination boundary condition				✓	✓
WKB tunneling model				✓	✓
Improved electric currents in layered shells functionality					✓
Lorentz Coupling multiphysics for electroacoustic transducers					✓
Hard magnet materials library for permanent magnets					✓
Utility application for checking B-H curves					✓
Coil improvements including spatially dependent conductivity					✓

ELECTROMAGNETICS	4.X	5.0–2	5.3	5.4	5.5
Updated AC/DC physics interfaces model wizard tree					✓
Extended support for Jiles-Atherton hysteresis					✓
Specific absorption rate (SAR) postprocessing variable					✓
Mixed-mode S-parameters					✓
Full-wave and ray optics simulation coupling					✓
New TEM and Via type ports					✓
Calculate and remove unwanted frequencies from simulation					✓
25 new dielectric materials for RF modeling					✓
More effective 3D antenna functions from 2D axisymmetric models					✓
Plot S-parameters while solving					✓
RF add-ins for S-parameter analysis and touchstone export					✓
Gaussian beam input option for scattering and matched boundary conditions					✓
Default Polarization plots and Jones vector variables					✓
Evanescent waves for Gaussian beam background fields					✓
Reference points for Scattering and Matched boundary conditions					✓
Slit ports for the Beam Envelopes interface					✓
Release rays from a surface using the calculated electric field					✓
Release rays from a calculated far field radiation pattern					✓
Dedicated Spot Diagram plot					✓
Improved Optical Aberration plot					✓
Cross Grating feature and grating improvements					✓
Air model for exterior and void domains					✓
Hexapolar cone release type					✓
New polygonal mirror parts					✓
Aspheric lens and mirror parts					✓
Doublet and triplet lens parts					✓
Preview grid release positions					✓
Isotropic scattering wall condition					✓
Computed electron energy distribution function (EEDF)					✓
New tools for modeling electrostatic precipitators					✓
New physics interface for detecting electrical breakdown					✓
Density-gradient formulation for semiconductor device simulations					✓
Trap-assisted heterointerface recombination feature					✓
Specify any arbitrary current density at a heterojunction					✓

HEAT TRANSFER	4.X	5.0–2	5.3	5.4	5.5
Multilayered shells	✓	✓	✓	✓	✓
Fans and grilles	✓	✓	✓	✓	✓
External radiation sources	✓	✓	✓	✓	✓
Solar irradiation	✓	✓	✓	✓	✓
Total power heat sources	✓	✓	✓	✓	✓
Moist air and condensation	✓	✓	✓	✓	✓
Load cases	✓	✓	✓	✓	✓
Multiwavelength radiation	✓	✓	✓	✓	✓
Phase change with apparent heat capacity method	✓	✓	✓	✓	✓
Thermal contact with surface roughness	✓	✓	✓	✓	✓
Fast methods for radiation in participating media	✓	✓	✓	✓	✓
Multiphysics interface for thermoelectric effect	✓	✓	✓	✓	✓
Bioheating damage integral analysis	✓	✓	✓	✓	✓
Easy verification of global heat and energy balances	✓	✓	✓	✓	✓
Mixed low- and high-conductive multilayered shells		✓	✓	✓	✓
Heat transfer in fractures		✓	✓	✓	✓
Heat transfer in highly conductive rods		✓	✓	✓	✓
Cryogenic damage integral analysis		✓	✓	✓	✓
Fans and grilles for turbulent flow		✓	✓	✓	✓
Viscous dissipation		✓	✓	✓	✓
Isothermal domains		✓	✓	✓	✓
List of solar positions for cities		✓	✓	✓	✓
Multiphysics interface for nonisothermal flow		✓	✓	✓	✓
Algebraic turbulence models		✓	✓	✓	✓
Multiphysics interface for local thermal nonequilibrium		✓	✓	✓	✓
Coupled porous media and turbulent flow		✓	✓	✓	✓
Nonisothermal flow in porous media		✓	✓	✓	✓
Deposited beam power tool		✓	✓	✓	✓
Multiphysics interface for the Marangoni effect		✓	✓	✓	✓
Blackbody intensity and emissive power functions		✓	✓	✓	✓
5 times faster bioheating		✓	✓	✓	✓
Symmetry plane for surface-to-surface radiation		✓	✓	✓	✓
Meteorological database for ambient conditions		✓	✓	✓	✓
Multiphysics interface for heat and moisture transport		✓	✓	✓	✓
Buoyancy effects in conjugate heat transfer		✓	✓	✓	✓
Heat transfer in building materials		✓	✓	✓	✓
Sector symmetry for heat radiation		✓	✓	✓	✓
Updated bioheat material database		✓	✓	✓	✓

HEAT TRANSFER	4.X	5.0–2	5.3	5.4	5.5
Heat transfer in the frequency domain			✓	✓	✓
Geometry parts for heat sinks			✓	✓	✓
Library of building and refrigerant materials			✓	✓	✓
Irreversible transformations in solids			✓	✓	✓
Serendipity elements for heat transfer			✓	✓	✓
Surface-to-surface radiation symmetry for perpendicular planes			✓	✓	✓
Mixed diffuse and direct solar radiation			✓	✓	✓
New Moisture Flow multiphysics coupling interface			✓	✓	✓
Moisture transfer coefficients			✓	✓	✓
New inflow boundary condition based on known upstream conditions			✓	✓	✓
Beer-Lambert law for absorption of light in weakly absorbing media			✓	✓	✓
Thermally induced irreversible transformations in solids			✓	✓	✓
Thermal contact by an equivalent thin resistive layer			✓	✓	✓
Heat transfer coefficients library for arbitrary fluids			✓	✓	✓
Meteorological database expanded to 8000 weather stations			✓	✓	✓
Heat transfer in shape memory alloys (SMA)			✓	✓	✓
Updated Electromagnetic Heating multiphysics coupling			✓	✓	✓
Updated Thermoelectric Effect multiphysics coupling			✓	✓	✓
Mixed diffuse-specular reflections and semitransparent surfaces				✓	✓
Heat transfer in thin, layered structures				✓	✓
Scattering control for radiation in participating media				✓	✓
Arbitrary number of spectral bands for surface-to-surface radiation				✓	✓
Light-diffusion equation interface				✓	✓
Multiphysics couplings for heat transfer with radiation				✓	✓
Multiphysics interfaces for heat and moisture flow				✓	✓
New Heat Transfer in Solids and Fluids interface				✓	✓
Thermal insulation for interior boundaries				✓	✓
Ambient Thermal Properties tool				✓	✓
Dedicated plots for temperature discontinuities				✓	✓
Multiphysics interface for thermoelectric effects in composite materials				✓	✓
NEW Product: Metal Processing Module					✓
New Lumped Thermal System interface					✓
Multiple spectral bands for radiation in participating media					✓
Wavelength dependent emissivity for ambient radiation					✓
Open Boundary and Inflow features for moisture transport					✓
Surface-to-Surface radiation with ray shooting method					✓
Multiphysics coupling for heat transfer in thin structures					✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
PMLs for piezoelectric materials	✓	✓	✓	✓	✓
Infinite elements for solid mechanics	✓	✓	✓	✓	✓
Prestressed analysis	✓	✓	✓	✓	✓
NEW Product: Geomechanics Module	✓	✓	✓	✓	✓
Voigt notation for anisotropic materials	✓	✓	✓	✓	✓
Specify elastic materials using 9 different property combinations	✓	✓	✓	✓	✓
Thin-film damping for MEMS	✓	✓	✓	✓	✓
New contact solver based on double dogleg method	✓	✓	✓	✓	✓
Load cases	✓	✓	✓	✓	✓
Membranes	✓	✓	✓	✓	✓
Cyclic and Floquet periodicity	✓	✓	✓	✓	✓
Rigid connectors	✓	✓	✓	✓	✓
Low-reflecting boundary conditions for transient elastic waves	✓	✓	✓	✓	✓
Buckling for trusses	✓	✓	✓	✓	✓
NEW Product: Nonlinear Structural Materials Module	✓	✓	✓	✓	✓
Yeoh, Varga, and Blatz-Ko hyperelasticity	✓	✓	✓	✓	✓
Dilation angle for soil	✓	✓	✓	✓	✓
NEW Product: Fatigue Module	✓	✓	✓	✓	✓
Bolt pretension	✓	✓	✓	✓	✓
Beam cross-section user interface	✓	✓	✓	✓	✓
Gent, Gao, and Storakers hyperelasticity	✓	✓	✓	✓	✓
Rainflow fatigue analysis	✓	✓	✓	✓	✓
NEW Product: Multibody Dynamics Module	✓	✓	✓	✓	✓
Multiphysics interface for MEMS thermoelasticity	✓	✓	✓	✓	✓
Thermal expansion for piezomaterials	✓	✓	✓	✓	✓
Rotordynamic forces	✓	✓	✓	✓	✓
Contact penalty method	✓	✓	✓	✓	✓
Solid-shell and shell-beam connections	✓	✓	✓	✓	✓
Rigid domains	✓	✓	✓	✓	✓
Timoshenko beams	✓	✓	✓	✓	✓
New thermal stress multiphysics interface	✓	✓	✓	✓	✓
Fatigue in nonlinear materials and thermal fatigue	✓	✓	✓	✓	✓
Fixed joint, distance joint, universal joint, and friction in joints	✓	✓	✓	✓	✓
Improved multiphysics interface for thermal stress	✓	✓	✓	✓	✓
Geometrically nonlinear beams		✓	✓	✓	✓
Improved fluid-structure interaction for fixed and flexible geometry		✓	✓	✓	✓
Spring and damper matrices		✓	✓	✓	✓
Multiphysics interface for hygroscopic swelling		✓	✓	✓	✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Easy couplings between shells and beams		✓	✓	✓	✓
Nonlinear elastic materials		✓	✓	✓	✓
Orthotropic, anisotropic, and hyperelastic membranes		✓	✓	✓	✓
Nonlinear elastic materials		✓	✓	✓	✓
Stress-life and strain-life fatigue models		✓	✓	✓	✓
Elastic joints and base motion for multibody dynamics		✓	✓	✓	✓
Multiphysics interfaces for multibody dynamics with heat transfer		✓	✓	✓	✓
Multiphysics interfaces for multibody dynamics with pressure acoustics		✓	✓	✓	✓
New multiphysics interface for the piezoelectric effect		✓	✓	✓	✓
Improved multiphysics interface for piezoelectric effect		✓	✓	✓	✓
Dielectric loss in piezoelectric materials		✓	✓	✓	✓
Built-in quartz material properties		✓	✓	✓	✓
Part Library for mechanical components		✓	✓	✓	✓
External stress interface		✓	✓	✓	✓
Viscous damping		✓	✓	✓	✓
Nonlinear elasticity, viscoelasticity, creep, and viscoplasticity for membranes		✓	✓	✓	✓
Plasticity in trusses		✓	✓	✓	✓
Point trajectory plots for multibody dynamics		✓	✓	✓	✓
Perforations in thin-film flow for MEMS		✓	✓	✓	✓
Material models from externally programmed libraries written in C		✓	✓	✓	✓
Optimized contact for small displacements		✓	✓	✓	✓
Adhesion and decohesion for mechanical contact		✓	✓	✓	✓
Multiphysics interface for magnetostriction		✓	✓	✓	✓
New plasticity material models		✓	✓	✓	✓
Multiphysics interface for piezoresistivity		✓	✓	✓	✓
Serendipity elements		✓	✓	✓	✓
Tangent coefficient of thermal expansion		✓	✓	✓	✓
Thermal expansion of constraints		✓	✓	✓	✓
Multiphysics interface for poroelasticity		✓	✓	✓	✓
Periodic conditions for shells		✓	✓	✓	✓
NEW Product: Rotordynamics Module		✓	✓	✓	✓
Solid and beam rotor interfaces for rotordynamic applications		✓	✓	✓	✓
Hydrodynamic bearings for rotordynamic applications		✓	✓	✓	✓
Whirl, Waterfall, and Orbit plots for rotordynamics applications		✓	✓	✓	✓
Large-strain viscoelasticity		✓	✓	✓	✓
Mixed isotropic and kinematic hardening		✓	✓	✓	✓
New isotropic and kinematic hardening material models for plasticity		✓	✓	✓	✓
Subsurface fatigue with the Dang-Van material model		✓	✓	✓	✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Gear modeling for multibody dynamics		✓	✓	✓	✓
Part Library with parameterized gears		✓	✓	✓	✓
Stress linearization evaluation of membrane, bending, and peak stress			✓	✓	✓
Study step and automatic symmetry detection for prestressed bolts			✓	✓	✓
Automatic suppression of rigid body motion			✓	✓	✓
Computation of safety factors for 12 safety criteria			✓	✓	✓
Linear buckling analysis for beams			✓	✓	✓
Dedicated data set for shell analysis			✓	✓	✓
Material data for thin elastic layers and spring foundation			✓	✓	✓
2D cross-sectional mode analysis for out-of-plane elastic waves			✓	✓	✓
Multiplicative decomposition of inelastic strains			✓	✓	✓
Rigid domain for shells and beams			✓	✓	✓
Rigid connector for beams			✓	✓	✓
Spring boundary conditions for rigid domains and connectors			✓	✓	✓
Complete set of energy variables for mechanical contact			✓	✓	✓
Frequency-response of mechanical contact models			✓	✓	✓
Extended functionality for external material models written in C			✓	✓	✓
Perzyna and Chaboche viscoplastic material models			✓	✓	✓
Material models for porous plasticity			✓	✓	✓
Anisotropic thermal expansion and hygroscopic swelling for hyperelastic materials			✓	✓	✓
Hardening of elliptic caps in soil plasticity analyses			✓	✓	✓
Vibration fatigue analysis			✓	✓	✓
Highlighting of joints for multibody dynamics analyses			✓	✓	✓
Penalty method for computing joint forces			✓	✓	✓
Attachments on rigid bodies			✓	✓	✓
Inlets and outlets for hydrodynamic bearings			✓	✓	✓
Rotor bearing system simulator application			✓	✓	✓
Shape memory alloy (SMA) material models			✓	✓	✓
Generalized multiphysics interface for fluid-structure interaction (FSI)			✓	✓	✓
Bolt thread contact modeling			✓	✓	✓
Solid-beam coupling in 3D models			✓	✓	✓
Generalized plane strain formulation			✓	✓	✓
Cam-follower joint condition for multibody dynamics			✓	✓	✓
Lumped mechanical system interface			✓	✓	✓
Ball and roller bearings for rotordynamics simulations			✓	✓	✓
Improved default plots for several structural mechanics interfaces			✓	✓	✓
C-profile and hat beam cross sections			✓	✓	✓
Option to exclude the constraints on lower geometric entity levels			✓	✓	✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Eigenfrequency analysis following a mechanical contact analysis			✓	✓	✓
Mechanical losses associated to thermal stress			✓	✓	✓
Failure criteria for membranes and concrete			✓	✓	✓
Plastic hardening and void nucleation in porous plasticity			✓	✓	✓
New soil material models: Modified Cam-Clay, Hardening Soil, Extended Barcelona Basic, and Modified Structured Cam-Clay			✓	✓	✓
Solid-bearing multiphysics coupling for hydrodynamic bearings			✓	✓	✓
Hydrodynamic thrust bearings			✓	✓	✓
NEW Product: Composite Materials Module				✓	✓
New user interfaces for defining layered stacks and orientation for composite materials				✓	✓
Layered material data sets and plots				✓	✓
Composite material analysis based on layerwise and equivalent single layer theory				✓	✓
Response spectrum analysis				✓	✓
Representative volume elements (RVE) for homogenization of periodic materials				✓	✓
Shell interface for axisymmetric analysis				✓	✓
Multiphysics interface for fluid-structure interaction with shells and membranes				✓	✓
Multiphysics interface for fluid-structure interaction with composite materials				✓	✓
Multiphysics interface for fluid-structure interaction with structural assemblies				✓	✓
Multiphysics interface for fluid-structure interaction with multibody dynamics of rigid and flexible bodies				✓	✓
Multiphysics interface for acoustic-structure interaction with composite materials				✓	✓
Multiphysics interface for thermal expansion in composite materials				✓	✓
Multiphysics interface for Joule heating in composite materials				✓	✓
Multiphysics interface for thermoelectric effect in composite materials				✓	✓
Activation of material for additive manufacturing				✓	✓
Roller condition with analytical normal orientation				✓	✓
Reaction-free symmetry boundary conditions				✓	✓
New studies for modal superposition in the time and frequency domain				✓	✓
Burgers viscoelastic model				✓	✓
Rigid connectors for edges and points				✓	✓
Flexible formulation for rigid connectors and attachments				✓	✓
Utility function library for external materials				✓	✓
Mullins effect for hyperelastic materials				✓	✓
Continuum-based damage model for brittle materials				✓	✓
New modeling options for hyperelastic materials with low compressibility				✓	✓
Fatigue evaluation for membranes				✓	✓
Mean stress correction for fatigue analysis based on the Goodman, Gerber, and Soderberg methods				✓	✓
Rolling element bearings for multibody dynamics				✓	✓
Body defining reference frame for results and visualizations				✓	✓
Floating ring bearings				✓	✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Misalignment in bearings				✓	✓
Rotor coupling				✓	✓
Foundations for roller bearings				✓	✓
Roller force distribution				✓	✓
Multiphysics interface for electromechanics with structural FEM and electrostatics BEM				✓	✓
Contact modeling extended to Shell, Layered Shell, and Membrane interfaces					✓
Decohesion enhancements					✓
Multiphysics interface for FSI with heat transfer					✓
FSI for two-phase flows					✓
Mechanical analysis of pipes					✓
Solid mechanics on rotating domains					✓
Nonrigid joints in beams					✓
Random vibration analysis					✓
Automatic visualization of loads					✓
User-defined material option for membranes					✓
Point selections in rigid connector for shells					✓
Direct stiffness input for shells and plates					✓
Multiphysics coupling for heat transfer in thin structures					✓
Multiphysics for acoustic-structure interaction with time explicit interfaces					✓
Johnson-Cook model for strain-dependent plasticity					✓
Lagoudas material model enhancements for shape memory alloys					✓
Hyperelastic material in the layered shell interface					✓
Plasticity in layered shells					✓
Piezoelectric material modeling in layered shells					✓
Material activation in layered shells					✓
Delamination in layered shalls					✓
New failure criteria for layered shells					✓
More multiphysics couplings in layered shells					✓
New structural couplings for layered shells					✓
Layered linear elastic material in the shell and membrane interfaces					✓
Mixed-formulation in layered shells					✓
Variable layer thickness in layered shells					✓
Transform option in layered materials					✓
New options for layer interface selection					✓
Automatic visualization of 3D solid geometry of composites					✓
Visualization of fiber draping					✓
Visualization enhancements for layered materials					✓
Mean stress tension cut-off criterion for soil plasticity					✓
Roller chain sprocket modeling					✓

STRUCTURAL MECHANICS	4.X	5.0–2	5.3	5.4	5.5
Automatic setup of rigid domains and gears					✓
Dynamic coefficients calculation in hydrodynamic bearings					✓
Multi-Spool Bearing feature					✓
Squeeze Film Damper feature					✓
Default geometry plot for beam rotors					✓

ACOUSTICS	4.X	5.0–2	5.3	5.4	5.5
Multiphysics interface for acoustic-piezo interactions	✓	✓	✓	✓	✓
Multiphysics interface for acoustic-shell interactions	✓	✓	✓	✓	✓
Multiphysics interface for poroelastic waves	✓	✓	✓	✓	✓
Multiphysics interface for thermoviscous acoustics	✓	✓	✓	✓	✓
Multiphysics interface for thermoviscous acoustic-solid interactions	✓	✓	✓	✓	✓
Multiphysics interface for time-domain pipe acoustics	✓	✓	✓	✓	✓
Multiphysics interface for membrane-acoustic interactions	✓	✓	✓	✓	✓
Multiphysics interface for thermoviscous acoustic-shell interactions	✓	✓	✓	✓	✓
Thermoviscous acoustic boundary condition approximation	✓	✓	✓	✓	✓
Multiphysics interface for frequency-domain pipe acoustics	✓	✓	✓	✓	✓
Aeroacoustics with linearized Euler equations	✓	✓	✓	✓	✓
Ray acoustics		✓	✓	✓	✓
Acoustic diffusion		✓	✓	✓	✓
New multiphysics interface for the piezoelectric effect		✓	✓	✓	✓
Aeroacoustics with linearized Navier-Stokes equations		✓	✓	✓	✓
Predefined impedance boundary conditions		✓	✓	✓	✓
Expanded poroacoustic fluid models		✓	✓	✓	✓
Dipole and quadrupole sources		✓	✓	✓	✓
Visualize far fields on grid outside computational mesh		✓	✓	✓	✓
Octave plots		✓	✓	✓	✓
New multiphysics interface for poroelastic waves		✓	✓	✓	✓
Discontinuous Galerkin method for ultrasound with background flow		✓	✓	✓	✓
Directivity plot		✓	✓	✓	✓
Background acoustic fields for thermoviscous acoustics		✓	✓	✓	✓
Background acoustic fields for linearized Navier-Stokes and Euler aeroacoustics		✓	✓	✓	✓
Ray power and sound pressure level for ray acoustics		✓	✓	✓	✓
Acoustic ray propagation outside CAD geometry		✓	✓	✓	✓
Cylindrical and spherical waves for background fields in pressure acoustics		✓	✓	✓	✓
Electroacoustic couplings for loudspeakers		✓	✓	✓	✓
Logarithmic and ISO preferred frequency sweeps		✓	✓	✓	✓
Perfectly matched layers (PMLs) for pressure acoustics in the time domain			✓	✓	✓
Thermoviscous acoustics in the time domain			✓	✓	✓

ACOUSTICS	4.X	5.0–2	5.3	5.4	5.5
Serendipity elements for acoustics			✓	✓	✓
New numerical stabilization for linearized Navier-Stokes analyses			✓	✓	✓
2D axisymmetric convected wave equation based on the discontinuous Galerkin method			✓	✓	✓
Thermal and viscous losses in poroelastic waves based on the Biot-Allard model			✓	✓	✓
Interior Perforated plate condition			✓	✓	✓
Beam width calculations for far-field plots			✓	✓	✓
Hybrid BEM-FEM for acoustics, acoustic-structure, and acoustics-piezo interactions			✓	✓	✓
Impulse response analysis for ray acoustics			✓	✓	✓
Discontinuous Galerkin explicit method for time-dependent acoustics			✓	✓	✓
Absorbing layers for linearized Euler aeroacoustics in the time domain			✓	✓	✓
Plane wave expansion for pressure acoustics in 2D axisymmetric models			✓	✓	✓
Incident monochromatic plane waves for transient acoustics			✓	✓	✓
Linear and logarithmic frequency axis option for directivity plots			✓	✓	✓
Improved solver suggestions for multiphysics couplings and transient analysis			✓	✓	✓
Port boundary conditions for pressure acoustics				✓	✓
Nonlinear acoustics Westervelt model for high sound pressure levels				✓	✓
Atmosphere and ocean attenuation material models				✓	✓
Exterior field calculation for evaluations outside the computational domain				✓	✓
Multiphysics BEM-FEM coupling to thermoviscous acoustics				✓	✓
Multiphysics BEM-FEM coupling to poroelastic waves				✓	✓
Interior velocity and interior displacement boundary conditions for BEM				✓	✓
Impedance condition, including RCL circuit and physiological, for BEM				✓	✓
Adiabatic formulation for linearized Navier-Stokes and thermoviscous acoustics				✓	✓
Gradient term suppression stabilization for linearized Navier-Stokes				✓	✓
Modulated Gaussian pulse option for background and incident fields				✓	✓
More advanced properties for the built-in materials for air and water				✓	✓
Improved method for calculating intensity in absorbing and attenuating media				✓	✓
New Elastic Waves, Time Explicit physics interface					✓
Multiphysics for acoustics-structure interaction with the time explicit interfaces					✓
Material discontinuity, pair conditions, and dissipation for time explicit interfaces					✓
Ports for thermoviscous acoustics					✓
Updated Port feature for pressure acoustics					✓
Background fluid flow coupling and mapping study for aeroacoustics					✓
Lorentz coupling for modeling electroacoustic transducers					✓
Acoustic-Pipe Acoustic Connection multiphysics coupling					✓
Acoustic-structure couplings for layered shells					✓
Improved acoustophoretic force					✓
New release and scattering features for ray acoustics					✓
Improvements to iterative solver suggestions					✓

ACOUSTICS	4.X	5.0–2	5.3	5.4	5.5
Anisotropic materials in pressure acoustics					✓
New solvers for large frequency-domain acoustic problems					✓

FLUID FLOW	4.X	5.0–2	5.3	5.4	5.5
High Mach number flow	✓	✓	✓	✓	✓
NEW Product: Microfluidics Module	✓	✓	✓	✓	✓
k-omega turbulence model	✓	✓	✓	✓	✓
Euler-Euler two-phase flow	✓	✓	✓	✓	✓
Slip flow	✓	✓	✓	✓	✓
Turbulent mixing	✓	✓	✓	✓	✓
NEW Product: Pipe Flow Module	✓	✓	✓	✓	✓
Automatic boundary layer meshing	✓	✓	✓	✓	✓
Turbulent reacting flow	✓	✓	✓	✓	✓
SCCM inflow	✓	✓	✓	✓	✓
Frozen rotor method	✓	✓	✓	✓	✓
SST turbulence	✓	✓	✓	✓	✓
Thin screens	✓	✓	✓	✓	✓
Heat transfer with phase change	✓	✓	✓	✓	✓
Two-phase flow in pipes	✓	✓	✓	✓	✓
Multiphysics interface for frequency-domain pipe acoustics	✓	✓	✓	✓	✓
NEW Product: Molecular Flow Module	✓	✓	✓	✓	✓
Wall surface roughness for turbulent flow	✓	✓	✓	✓	✓
Anisotropic porous media flow with Brinkman equations	✓	✓	✓	✓	✓
NEW Product: Mixer Module	✓	✓	✓	✓	✓
Algebraic turbulence models		✓	✓	✓	✓
Turbulence with grilles and fans		✓	✓	✓	✓
New multiphysics interface for nonisothermal flow		✓	✓	✓	✓
SST turbulence model for reacting flow		✓	✓	✓	✓
Cavitation for thin-film flow		✓	✓	✓	✓
Rotating machinery with multiphase flow		✓	✓	✓	✓
Multiphysics interface for transport of diluted species in porous media		✓	✓	✓	✓
Partially saturated porous media		✓	✓	✓	✓
3D laminar flow to 1D pipe flow connection		✓	✓	✓	✓
Euler-Euler two-phase flow for turbulent flow		✓	✓	✓	✓
Coupled porous media and turbulent flow		✓	✓	✓	✓
Capillary pressure in two-phase porous media flow		✓	✓	✓	✓
Perforations for thin-film flow		✓	✓	✓	✓
Infinite elements for porous media		✓	✓	✓	✓

FLUID FLOW	4.X	5.0–2	5.3	5.4	5.5
Part Library with mixer equipment components		✓	✓	✓	✓
Part Library with microfluidic channels		✓	✓	✓	✓
New y-junctions and n-way junctions for pipe flow		✓	✓	✓	✓
Parallelized molecular flow computations		✓	✓	✓	✓
Molecular flow with multiple species		✓	✓	✓	✓
Three-phase laminar flow		✓	✓	✓	✓
Algebraic turbulence for rotating machinery		✓	✓	✓	✓
Stationary free surface flow computation		✓	✓	✓	✓
Algebraic turbulence for mixing		✓	✓	✓	✓
Compressible flow in 1D pipes		✓	✓	✓	✓
Easy definition of gravity and buoyancy effects		✓	✓	✓	✓
Built-in Boussinesq approximation for nonisothermal flow		✓	✓	✓	✓
Swirl flow for Fan boundary condition		✓	✓	✓	✓
Temperature changes from pressure work in porous media flow		✓	✓	✓	✓
Multiphysics interface for reacting flow		✓	✓	✓	✓
Graphics icons for pipe system components		✓	✓	✓	✓
Pump inlet condition and pump curve data for pipe flow		✓	✓	✓	✓
Flownet plots for subsurface flow		✓	✓	✓	✓
v2-f turbulence model			✓	✓	✓
Automatic wall treatment for turbulent flow			✓	✓	✓
Automatic translation between turbulence models			✓	✓	✓
Algebraic multigrid (AMG) solver for CFD			✓	✓	✓
New formulation for high Mach number flow			✓	✓	✓
New interior wall and thin barrier boundary conditions for porous media flow			✓	✓	✓
New well boundary condition for subsurface flow in porous media			✓	✓	✓
Reacting flow in porous media			✓	✓	✓
Transport of diluted species in porous media and fractures			✓	✓	✓
Plane symmetry condition for free molecular flow			✓	✓	✓
Generalized multiphysics interface for fluid-structure interaction (FSI)			✓	✓	✓
Inlet boundary conditions for fully developed turbulent flow			✓	✓	✓
Realizable k-ε turbulence model			✓	✓	✓
Buoyancy-induced turbulence			✓	✓	✓
All turbulence models made available for multiphase flow			✓	✓	✓
Rotating machinery interfaces made available for all flow interfaces			✓	✓	✓
Updated free and porous media flow interface			✓	✓	✓
Kozeny-Carman permeability model for Darcy's law			✓	✓	✓
Thin barrier feature in the two-phase Darcy's law interface			✓	✓	✓
Cubic law for fracture transmissivity in fracture flow			✓	✓	✓

FLUID FLOW	4.X	5.0–2	5.3	5.4	5.5
Large eddy simulation (LES) for single-phase flow				✓	✓
Phase transport in free and porous media				✓	✓
Fully developed flow at inlets and outlets for turbulent flow				✓	✓
Non-Newtonian yield-stress fluids: Bingham-Papanastasiou, Casson-Papanastasiou models, Herschel-Bulkley-Papanastasiou				✓	✓
Two-phase flow with level set and phase field for all turbulence models				✓	✓
Interior wetted wall for two-phase flow				✓	✓
Pipe connection for combining 1D pipe flow with 3D single-phase flow				✓	✓
NEW Product: Porous Media Flow Module					✓
Viscoelastic flow					✓
Compressible Euler equations					✓
Phase transport mixture model for arbitrary number of dispersed phases					✓
Nonisothermal large eddy simulation (LES)					✓
Continuity and Initial Interface pair features					✓
Inelastic non-Newtonian constitutive relations					✓
Interior Slip Wall feature					✓
Ambient properties for subsurface flow					✓
Reacting flow in porous media					✓
Heat transfer in fractures					✓
Brunauer-Emmett-Teller (BET) and Toth isotherms adsorption models					✓
Non-Darcian flow					✓
Automatic selection of T-junctions and Y-junctions					✓
Acoustic-Pipe Acoustics Connection multiphysics coupling					✓
Mechanical analysis of pipes					✓

CHEMICAL	4.X	5.0–2	5.3	5.4	5.5
Surface reactions	✓	✓	✓	✓	✓
Infinite elements for diffusion	✓	✓	✓	✓	✓
Parameter estimation with the Optimization Module	✓	✓	✓	✓	✓
Reacting flow	✓	✓	✓	✓	✓
AC impedance spectroscopy	✓	✓	✓	✓	✓
NEW Product: Electrodeposition Module	✓	✓	✓	✓	✓
Infinite elements for electrochemical currents	✓	✓	✓	✓	✓
Shell electrodes	✓	✓	✓	✓	✓
Potentiostatic control	✓	✓	✓	✓	✓
NEW Product: Corrosion Module	✓	✓	✓	✓	✓
Film resistance	✓	✓	✓	✓	✓
Thin impermeable barrier	✓	✓	✓	✓	✓
Edge electrodes	✓	✓	✓	✓	✓

CHEMICAL	4.X	5.0–2	5.3	5.4	5.5
Infinite electrolytes	✓	✓	✓	✓	✓
NEW Product: Electrochemistry Module	✓	✓	✓	✓	✓
Multicomponent flash calculations	✓	✓	✓	✓	✓
Multiscale simulations for packed bed reactors		✓	✓	✓	✓
New Chemistry interface		✓	✓	✓	✓
Multiphysics interface for transport of diluted species in porous media		✓	✓	✓	✓
Mass-based concentrations		✓	✓	✓	✓
Partially saturated porous media		✓	✓	✓	✓
Equilibrium reactions		✓	✓	✓	✓
Current distribution on edges with the boundary element method (BEM)		✓	✓	✓	✓
Counter electrodes for electroanalysis		✓	✓	✓	✓
New gas mixture viscosity correlation for reaction engineering		✓	✓	✓	✓
Film resistance for reactive pellets		✓	✓	✓	✓
Multiphysics interface for hygroscopic swelling with species transport		✓	✓	✓	✓
Dusty gas model		✓	✓	✓	✓
Mass-based concentration variables		✓	✓	✓	✓
Nonspherical catalytic pellet shapes		✓	✓	✓	✓
Volumetric effects from edge elements		✓	✓	✓	✓
Thin insulating sheets for corrosion simulations		✓	✓	✓	✓
Multicomponent transport in porous media flow		✓	✓	✓	✓
Surface reactions for reactive pellet beds		✓	✓	✓	✓
Export surface reaction kinetics to space-dependent model		✓	✓	✓	✓
Single particle battery interface for simplified modeling of batteries		✓	✓	✓	✓
Nernst-Planck-Poisson equations interface		✓	✓	✓	✓
Short-circuit boundary condition for batteries and corrosion		✓	✓	✓	✓
Multiphysics interface for electrochemical heat source		✓	✓	✓	✓
Thermodynamic equilibrium electrode kinetics		✓	✓	✓	✓
Electrophoretic transport interface			✓	✓	✓
Ion-exchange membrane internal boundary condition for tertiary currents			✓	✓	✓
Four charge conservation models for tertiary currents with Nernst-Planck equations			✓	✓	✓
Thin electrode layers in electrode domains			✓	✓	✓
Thin electrolyte layers between electrolyte domains			✓	✓	✓
Charge-discharge cycling boundary condition			✓	✓	✓
Circuit terminal for couplings to electrical circuits			✓	✓	✓
Primary and secondary current distribution based on the boundary element method (BEM)			✓	✓	✓
Shell current distribution analysis for thin electrolytes			✓	✓	✓
A built-in thermodynamic properties library for pure fluids, mixtures, and two-phase fluids			✓	✓	✓
Link between Reaction Engineering and Chemistry interfaces and thermodynamic property packages			✓	✓	✓

CHEMICAL	4.X	5.0–2	5.3	5.4	5.5
Electrode reactions on thin electrode surfaces fully immersed in electrolyte			✓	✓	✓
New Lithium-Ion Battery Designer application for optimizing batteries for specific use cases			✓	✓	✓
Baker-Verbrugge diffusion model, in the Lithium-Ion Battery and Battery with Binary Electrolyte interfaces				✓	✓
Updated Thermodynamics interface				✓	✓
Partition condition for prescribing the ratio between concentrations in two adjacent phases				✓	✓
Infinitely fast irreversible heterogeneous reactions				✓	✓
Bulk and surface equilibrium reactions for concentrated species				✓	✓
Automatic definition of equilibrium constants based on thermodynamics properties				✓	✓
Lumped battery interface				✓	✓
Stress and strain in electrode particles due to lithium intercalation				✓	✓
Equivalent circuit modeling of batteries				✓	✓
Multiple ion transport for ion-exchange membranes				✓	✓
Level set interface for corrosion modeling				✓	✓
Generate Material from a thermodynamic system					✓
Generate a Chemistry interface from a thermodynamic system					✓
Diffusivity models for gases and liquids					✓
Water and steam properties					✓
Single-ion conductor charge balance for solid-state batteries					✓
Lumped Battery interface improvements					✓
Equilibrium potential calculation using the Nernst Equation					✓
Concentration-dependent Butler-Volmer kinetics					✓
Electrode reactions for Batteries & Fuel Cells					✓
Mass flow rates Inflow condition					✓
Current Distribution, Pipe interface					✓

OPTIMIZATION	4.X	5.0–2	5.3	5.4	5.5
Time-dependent sensitivity and optimization	✓	✓	✓	✓	✓
Parameter optimization	✓	✓	✓	✓	✓
Design optimization	✓	✓	✓	✓	✓
Gradient-based and derivative-free optimization study	✓	✓	✓	✓	✓
New derivative-free optimization solver: BOBYQA	✓	✓	✓	✓	✓
New gradient-based optimization solver: MMA	✓	✓	✓	✓	✓
Multianalysis optimization		✓	✓	✓	✓
New parameter estimation study		✓	✓	✓	✓
Optimization solver stop and continue		✓	✓	✓	✓
New derivative-free method: COBYLA		✓	✓	✓	✓
New least square fitting method		✓	✓	✓	✓
Density model feature for topology optimization				✓	✓

OPTIMIZATION	4.X	5.0–2	5.3	5.4	5.5
Combined parametric sweeps with derivative-free optimization				✓	✓
Easier shape optimization setup					✓
Filter dataset for creating mesh part from topology optimization					✓
Compute confidence intervals for parameter estimation					✓
Strict enforcement of design constraints for parameter optimization					✓

MATERIAL LIBRARY PRODUCT	4.X	5.0–2	5.3	5.4	5.5
2500 materials	✓	✓	✓	✓	✓
More than 150 new materials			✓	✓	✓
New materials, totaling 3876 materials					✓

PARTICLE TRACING	4.X	5.0–2	5.3	5.4	5.5
NEW Product: Particle Tracing	✓	✓	✓	✓	✓
Particle forces: electric, magnetic, collisional, drag, gravity, acoustophoretic, dielectrophoretic, and user defined	✓	✓	✓	✓	✓
New forces: Brownian, Schiller-Naumann, magnetophoretic, and thermophoretic	✓	✓	✓	✓	✓
Secondary emission	✓	✓	✓	✓	✓
Particle-particle interactions	✓	✓	✓	✓	✓
Diffuse and general reflection	✓	✓	✓	✓	✓
Velocity reinitialization	✓	✓	✓	✓	✓
Monte Carlo elastic collisions	✓	✓	✓	✓	✓
Changing auxiliary variables	✓	✓	✓	✓	✓
Particle-field and fluid-particle interactions	✓	✓	✓	✓	✓
Release of particles in a cone	✓	✓	✓	✓	✓
Max, min, and average over particles	✓	✓	✓	✓	✓
New accumulator tools enabling multiphysics couplings for erosion, etching, mass deposition, boundary load, mass flux, current density, and heat source		✓	✓	✓	✓
Particle 1D plots		✓	✓	✓	✓
Multiphysics interface for electric-particle field interaction		✓	✓	✓	✓
Multiphysics interface for magnetic-particle field interaction		✓	✓	✓	✓
New multiphysics interface for fluid-particle interaction		✓	✓	✓	✓
Inelastic collisions		✓	✓	✓	✓
Particle beams with beam emittance and Twiss parameters		✓	✓	✓	✓
Space-charge limited emission		✓	✓	✓	✓
Charge-exchange collisions		✓	✓	✓	✓
Release from edges and points		✓	✓	✓	✓
Improved density-based release		✓	✓	✓	✓
Particle counters		✓	✓	✓	✓
Particle-matter interactions		✓	✓	✓	✓

PARTICLE TRACING	4.X	5.0–2	5.3	5.4	5.5
High-order Runge-Kutta time-stepping method for first-order Newtonian formulation		✓	✓	✓	✓
Store extra time steps for wall interactions		✓	✓	✓	✓
Improved particle beam simulations with sampling from phase space ellipse		✓	✓	✓	✓
Turbulent dispersion models for particles		✓	✓	✓	✓
Liquid droplet breakup with the Kelvin-Helmholtz and Rayleigh-Taylor breakup models		✓	✓	✓	✓
Periodic boundary condition for particle tracing			✓	✓	✓
Rotating frames for particle tracing			✓	✓	✓
Release particles at random initial positions			✓	✓	✓
Ribbons on particle trajectories			✓	✓	✓
Coordinate system selection for inlets			✓	✓	✓
Lambertian velocity distribution for particle release at boundaries			✓	✓	✓
Nonuniform magnitudes in velocity distributions			✓	✓	✓
Lift force for particle tracing in fluids			✓	✓	✓
Anisotropic turbulent dispersion for particles in fluids			✓	✓	✓
Thermionic emission of electrons at hot metal cathodes			✓	✓	✓
Drag correction factor for particles close to walls			✓	✓	✓
Symmetry boundary condition for particle tracing			✓	✓	✓
New component couplings on particles			✓	✓	✓
Null collision method for charged particle tracing in rarified gas			✓	✓	✓
Uniform, normal, or lognormal distribution of particle release times			✓	✓	✓
Recycling of particle degrees of freedom for use in secondary emission			✓	✓	✓
General time periodic electric and magnetic forces			✓	✓	✓
Release particles based on the thermal distribution on a wall			✓	✓	✓
Release particles from a cylindrical or hexapolar grid of points			✓	✓	✓
Accumulators for velocity reinitialization to compute, for example, spatial density of collisions				✓	✓
Offset velocity distributions of released particles				✓	✓
Faster particle tracing with coupled fields					✓
Virtual mass and pressure gradient forces					✓
Improved acoustophoretic force					✓
Particle size distributions					✓
Preview grid release positions					✓
Isotropic scattering wall condition					✓
New options for secondary particle emission at walls					✓
Built-in species for charged particle tracing					✓
Particle charging for fluid flow					✓
New tools for modeling electrostatic precipitators					✓

INTERFACING	4.X	5.0–2	5.3	5.4	5.5
NEW Product: LiveLink™ *for* AutoCAD®	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* PTC® Creo® Parametric™	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Excel®	✓	✓	✓	✓	✓
NEW Product: ECAD Import Module	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Solid Edge®	✓	✓	✓	✓	✓
NEW Product: LiveLink™ *for* Revit®	✓	✓	✓	✓	✓
NEW Product: Design Module	✓	✓	✓	✓	✓

NEW CAD FILE FORMATS	4.X	5.0–2	5.3	5.4	5.5
PTC® Creo® Parametric™ 1.0 software	✓	✓	✓	✓	✓
ACIS® (SAT®) R22 software	✓	✓	✓	✓	✓
CATIA® V5 R21 software	✓	✓	✓	✓	✓
Autodesk® Inventor® 2012 software	✓	✓	✓	✓	✓
Parasolid® R23, R24 software	✓	✓	✓	✓	✓
SOLIDWORKS® 2012 software	✓	✓	✓	✓	✓
Catia® V5 R 22 software	✓	✓	✓	✓	✓
Parasolid® V 25 software	✓	✓	✓	✓	✓
SOLIDWORKS® 2013 software	✓	✓	✓	✓	✓
Autodesk® Inventor® 2013 software	✓	✓	✓	✓	✓
PTC® Creo® Parametric™ 2.0 software	✓	✓	✓	✓	✓
NX™ (.prt) software		✓	✓	✓	✓
Autodesk® AutoCAD® (.dwg, .dxf) software		✓	✓	✓	✓
SOLIDWORKS® 2014 software		✓	✓	✓	✓
Autodesk® Inventor® 2015 software		✓	✓	✓	✓
Parasolid® V 28.1 software		✓	✓	✓	✓
ACIS® (SAT®) R25, 2016 1.0 software		✓	✓	✓	✓
CATIA® V5 R8-R25, 2016		✓	✓	✓	✓
Inventor® parts and assemblies versions 11, 2008-2016		✓	✓	✓	✓
SOLIDWORKS® versions 98-2016		✓	✓	✓	✓
AutoCAD® versions 2.5-2016		✓	✓	✓	✓
AutoCAD® DXF™ versions 2.5-2016		✓	✓	✓	✓
Parasolid® V 29.1 software			✓	✓	✓
ACIS® (SAT®) R25, 2017 1.0 software			✓	✓	✓
Inventor® parts and assemblies version 11, 2017			✓	✓	✓
SOLIDWORKS® 2017 software			✓	✓	✓
NX™ (.prt) software version 11			✓	✓	✓
Parasolid® V 30.0 software			✓	✓	✓
ACIS® (SAT®) R25, 2018 1.0 software			✓	✓	✓

NEW CAD FILE FORMATS	4.X	5.0–2	5.3	5.4	5.5
AutoCAD® (.dwg, .dxf) up to 2017			✓	✓	✓
CATIA® V5 up to 2017			✓	✓	✓
PTC® Creo® Parametric™ up to 4.0			✓	✓	✓
AutoCAD® (.dwg, .dxf) versions 2018-2019				✓	✓
Inventor® (.iam, .ipt) versions 2018-2019				✓	✓
NX™ (.prt) software version 12				✓	✓
Parasolid® (.x_t, .xmt_txt, .x_b, .xmt_bin): V31.0				✓	✓
PTC® Creo® Parametric™ (.prt, .asm): 5.0				✓	✓
SOLIDWORKS® (.sldprt, .sldasm): 2018				✓	✓
ACIS® (.sat, .sab, .asat, .asab): 2019 1.0					✓
NX™ (.prt): 1847					✓
Parasolid® (.x_t, .xmt_txt, .x_b, .xmt_bin): V32.0					✓
PTC® Creo® Parametric™ (.prt, .asm): 6.0					✓
SOLIDWORKS® (.sldprt, .sldasm): 2019					✓

LIVELINK™ *for* SOLIDWORKS®	4.X	5.0–2	5.3	5.4	5.5
One-window interface	✓	✓	✓	✓	✓
Parameter linking	✓	✓	✓	✓	✓
Sync material names	✓	✓	✓	✓	✓
Sync user-defined selections	✓	✓	✓	✓	✓
Run applications using LiveLink™ *for* SOLIDWORKS®		✓	✓	✓	✓
Connecting to COMSOL Server™ from within the SOLIDWORKS® interface		✓	✓	✓	✓
Tracking of document information including file name and file path		✓	✓	✓	✓
More efficient setup of CAD assembly selections			✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓
Assembly-level pattern features in selections				✓	✓
Synchronization of materials					✓

LIVELINK™ *for* INVENTOR®	4.X	5.0–2	5.3	5.4	5.5
Parameter linking	✓	✓	✓	✓	✓
One-window interface	✓	✓	✓	✓	✓
Sync material names and selections	✓	✓	✓	✓	✓
Connecting to COMSOL Server™ from within the Autodesk® Inventor® interface		✓	✓	✓	✓
Tracking of document information including file name and file path		✓	✓	✓	✓
More efficient setup of CAD assembly selections			✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓
Synchronization of materials					✓

LIVELINK™ *for* AUTOCAD®	4.X	5.0–2	5.3	5.4	5.5
Connecting to COMSOL Server™ from within the AutoCAD® interface			✓	✓	✓
Synchronize selections for materials			✓	✓	✓
Tracking of document information including file name and file path			✓	✓	✓
Synchronize curves and points			✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓

LIVELINK™ *for* PTC® PRO/ENGINEER®	4.X	5.0–2	5.3	5.4	5.5
Synchronize selections for materials		✓	✓	✓	✓
Tracking of document information including file name and file path		✓	✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓

LIVELINK™ *for* PTC® CREO® PARAMETRIC™	4.X	5.0–2	5.3	5.4	5.5
Synchronize selections for materials		✓	✓	✓	✓
Connecting to COMSOL Server™ from within the PTC® Creo® Parametric™ interface		✓	✓	✓	✓
Tracking of document information including file name and file path		✓	✓	✓	✓
Parameter selection in CAD assembly components			✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓
User-defined selections				✓	✓
Synchronization of materials					✓

LIVELINK™ *for* SOLID EDGE®	4.X	5.0–2	5.3	5.4	5.5
Synchronize selections for materials		✓	✓	✓	✓
Connecting to COMSOL Server™ from within the Solid Edge® interface		✓	✓	✓	✓
Tracking of document information including file name and file path		✓	✓	✓	✓
Synchronizing read-only parameters				✓	✓
Object selections from material selections				✓	✓
User-defined selections					✓
Synchronization of materials					✓

LIVELINK™ *for* REVIT®	4.X	5.0–2	5.3	5.4	5.5
Connecting to COMSOL Server™ from within the Autodesk® Revit® interface			✓	✓	✓
Tracking of document information including file name and file path			✓	✓	✓
Expanded support for synchronizing architectural elements			✓	✓	✓
Synchronizing read-only parameters				✓	✓

ECAD IMPORT MODULE	4.X	5.0–2	5.3	5.4	5.5
ODB++ import	✓	✓	✓	✓	✓
Layer renaming		✓	✓	✓	✓
Selections for layers		✓	✓	✓	✓
Split layers in imported GDS files based on data type			✓	✓	✓
Support for the IPC-2581 PCB layout format			✓	✓	✓
Net selections for ODB++ and IPC-2581 files				✓	✓
Select all metal and dielectric layers option				✓	✓
Clear all imports option				✓	✓
Automatically exclude objects outside board					✓
Reload layer information					✓

LIVELINK™ *for* MATLAB®	4.X	5.0–2	5.3	5.4	5.5
Improved performance and memory handling	✓	✓	✓	✓	✓
Model navigator	✓	✓	✓	✓	✓
New functions*	✓	✓	✓	✓	✓
Updates to mphnavigator , mpheval, mphint, mphinterp , mphplot, mphsolutioninfo, and mphtable	✓	✓	✓	✓	✓
New client/server functionality		✓	✓	✓	✓
Updates to mphplot		✓	✓	✓	✓
New functions: mphevaluate, mphinterpolationfile, mphwritestl, mphreadstl, and mphsurf		✓	✓	✓	✓
Updates to mphxmeshinfo, mphmean, mphmax, mphmin, and mphint2		✓	✓	✓	✓
New mphnavigator, mphopen, and mphload tools		✓	✓	✓	✓
Updates to mphplot and mphgeom		✓	✓	✓	✓
Updates to mphplot, and mphgetexpressions		✓	✓	✓	✓
Directivity plots (Acoustics Module) and optical aberration plots (Ray Optics) with mphplot			✓	✓	✓
Updates to mphevaluate, mphglobalmatrix, mphstate , mphmatrix, mphnavigator, and mphshowerrors			✓	✓	✓
New mphray function for ray optics and ray acoustics data sets			✓	✓	✓
Improved access to ray and particle data from parametric sweep studies in mphray and mphparticle			✓	✓	✓
Support for views in the mphplot, mphgeom, and mphmesh functions			✓	✓	✓
New mphthumbnail function for setting thumbnail images of models			✓	✓	✓
New mphdoc function for accessing the COMSOL documentation			✓	✓	✓
Connect to a COMSOL Multiphysics® server from MATLAB® and COMSOL Multiphysics® at the same time			✓	✓	✓
Access to functions from the Apps tab of the MATLAB® ribbon			✓	✓	✓
New function mphreduction for extracting reduced-order state-space matrices			✓	✓	✓
Updates to mphplot, mphmesh, and mphthumbnail			✓	✓	✓
Use MATLAB® function calls wherever you can use global parameters			✓	✓	✓
Updates to mphnavigator, mphsearch, and mphmodellibrary				✓	✓
Updates to mphplot: Layered shells, more polar plot options, and overlapping faces				✓	✓
Updates to mphnavigator, mphmodellibrary, mphgeom, mphmeasure, mphplot, mphtable					✓

*mphimage2geom, mphevalpoint, mphmean, mphmin, mphmax, mphevalglobalmatrix, mphsearch, mphinputmatrix, mphsolution, mphtable, and mphparticle.

LIVELINK™ *for* EXCEL®	4.X	5.0–2	5.3	5.4	5.5
Multiple files	✓	✓	✓	✓	✓
Interpolation functions	✓	✓	✓	✓	✓
Material export	✓	✓	✓	✓	✓
Connect to remote server	✓	✓	✓	✓	✓
Export of field-dependent material properties	✓	✓	✓	✓	✓
Parametric sweeps in worksheet	✓	✓	✓	✓	✓
Create macros with Visual Basic® for Applications (VBA) development system		✓	✓	✓	✓
Localized language support		✓	✓	✓	✓
LiveLink™ *for* Excel® for class kit licenses		✓	✓	✓	✓
Save model files for VBA		✓	✓	✓	✓
Save and load spreadsheet files		✓	✓	✓	✓
Automatically synchronized values for parameters and variables		✓	✓	✓	✓
Manage models and connections in the Microsoft® Excel® file tab			✓	✓	✓
Context-sensitive help			✓	✓	✓
Buttons for Results Parameters and for Clear and Evaluate All			✓	✓	✓
Export 1D plots more easily			✓	✓	✓