Is your analysis tool useful in years to come?

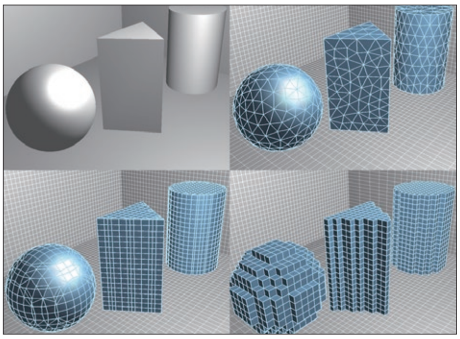
scSTREAM and HeatDesigner have proven track records for incorporating the latest leading edge technology

scSTREAM HeatDesigner

scSTREAM thermo-fluid software has serviced the electronics and architectural industries for more than thirty years. The ever-evolving software is characterized by its overwhelmingly user-friendly interfaces and high speed processing. HeatDesigner is based on scSTREAM and is specially developed for thermal design of electronics products. HeatDesigner provides physical functions required only for thermal design with its simple interfaces and powerful computing performance.

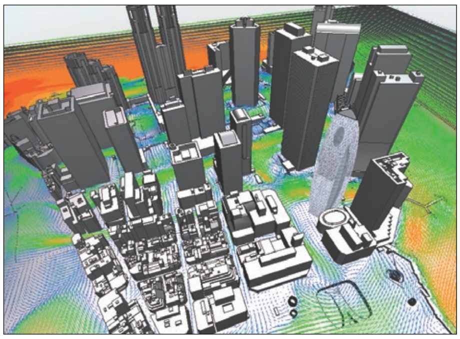
Various methods to represent shapes ST

The shape of a model to be analyzed can be represented by using the following methods: voxel method (slanted faces and curved faces are represented in cuboids), cut-cell method (the shape of a model created with a CAD tool can be represented more accurately), and finite element model method (a model of an arbitrary shape defined with unstructured mesh can be overlapped on a model defined with structured mesh to use the shape created with a CAD tool as is).



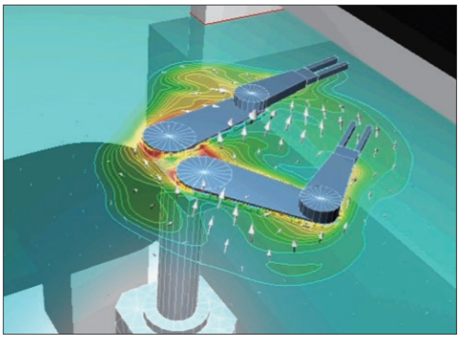
Large-scale calculation ST HD

In structured mesh, even a complicated model does not need to be modified almost at all and the shape or the scale of a model does not affect the difficulty of mesh generation. In addition, Solver performs a calculation at a high speed in parallel computing and achieves effective processing as the speed increases depending on the number of subdomains.



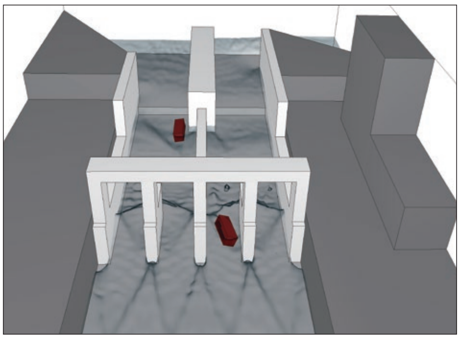
Moving objects ST

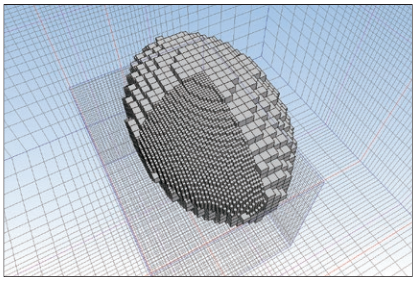
A flow generated by a moving rigid object can be calculated. Conditions including the motions of an object (translation, rotation, and elastic deformation), heat generation/absorption, and air supply/return can be set. The model of a moving object is created on another mesh. In this way, conditions such as the distance that the object moves are limited very little.

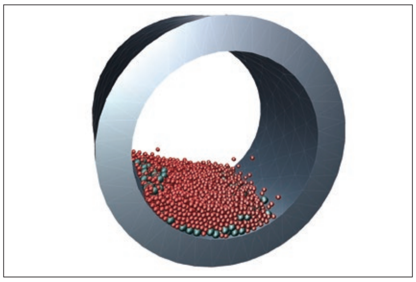


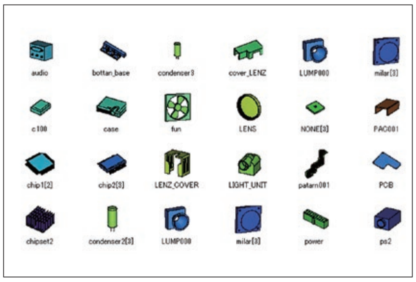
6-degree-of-freedom motion (6DOF) ST

The function can analyze passive translation and rotation of an object receiving a fluid force. A moving object is assumed to be a rigid body. Its movement whose maximum degree of freedom is six (3D translation + 3D rotation) can be solved. The function can simulate driftwood which is flowed by a force from water flow.









Multiblock ST HD

Mesh can be refined partially to represent a model shape more accurately and perform a calculation more efficiently.

Discrete element method (DEM) ST

Multiphase analyses can be performed, which enables coupling of fluid analysis and flow analysis of particles.

Parts library ST HD

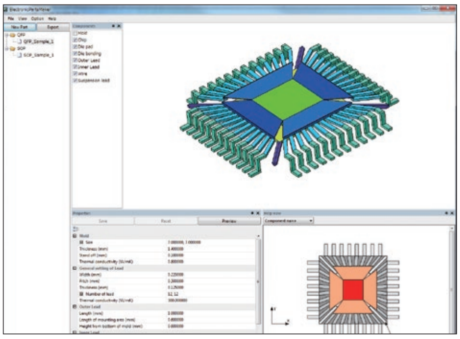
The shapes and conditions of frequently used parts can be registered. Conditions include the allocation position, material, and heat generation.

HeatPathView ST HD

The information on temperature of each part and a comprehensive amount of heat release obtained in post-processing of a general CFD analysis is not enough to know the heat path. HeatPathView displays heat paths and the amount of heat transfer in the whole computational domain in a diagram, a graph, and a table, allowing you to find the bottleneck of the heat paths easily.

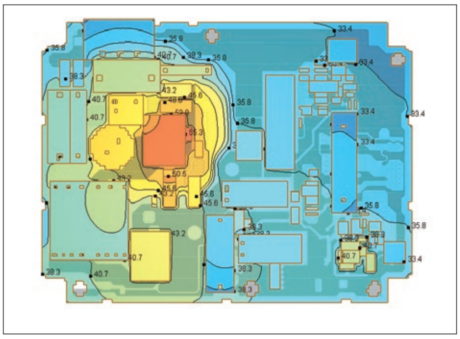
ElectronicPartsMaker ST HD

The tool can create detailed models of semiconductor packages including QFP, SOP, and BGA by specifying parameters, and simplified models using thermal resistor models such as DELPHI models and two-resistor models. Manufacturers of semiconductor packages can provide the data of semiconductor packages as thermal resistor models without releasing the inside information.



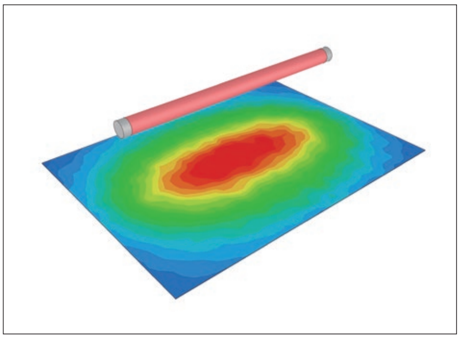
Reading wiring patterns ST HD

To calculate heat transfer conditions depending on wiring patterns of a printed circuit board (PCB) in detail, the module can read Gerber data output from an electric CAD tool and import the data as a model for a thermo-fluid analysis. By using Gerber data, a more realistic calculation result can be obtained with the consideration of heat transfer affected by an uneven wiring pattern.



Radiation ST HD

Radiation heat transfer with the consideration of diffusion, reflection, transmission, refraction, and absorption can be calculated. VF (view factor) method and FLUX method[*1] can be used. The lamp function can simulate radiant heat by a filament without detailed shape information of a lamp. In addition to the filament, laser beam and defective radiation specified by half-value angle can be used as a heat source model.

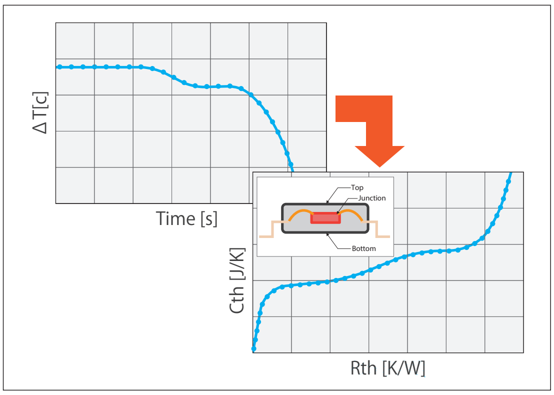


[*1] Only for scSTREAM

Using structure function from measurement

ST HD

Modeling of electronic device is possible by converting result data of heat change over time used for transient heat resistance measurement[*1] into structure function (thermal resistance - heat capacity characteristics). Accurate thermal model can be generated by comparing test and analysis data on the basis of structure function.

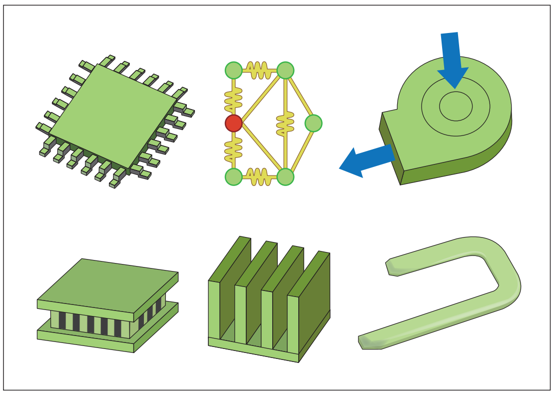


[*1] Measurement device is not included

Electronic part model

ST HD

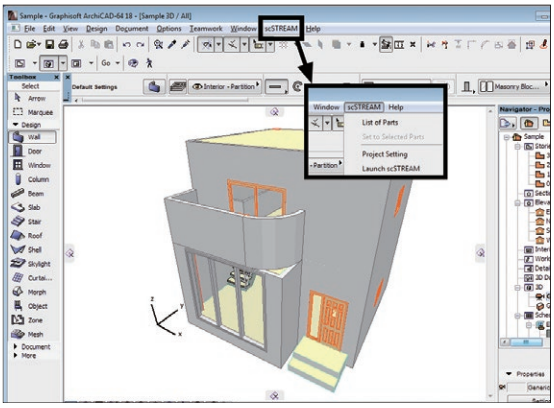
A wide range of models are available that enable to easily achieve thermal design of printed circuit boards and electronical enclosures, which includes DELPHI (multi-resistor) model, Peltier device and heat pipes. It is possible to consider pressure loss characteristics using slits, and P-Q characteristics of fans using swirling component. Generated models can be added in library.



BIM

ST

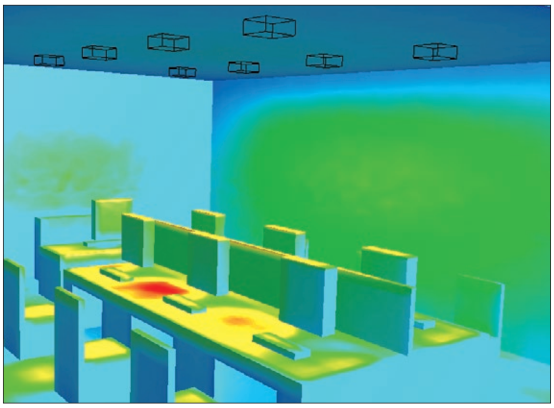
The software interface supports BIM 2.0. Autodesk® Revit® and GRAPHISOFT ARCHICAD have a direct interface (optional) through which a target part can be selected and the tree structure can be kept and simplified. In addition, the module can load files in IFC format, which is the BIM-standard format.



Illuminance analysis

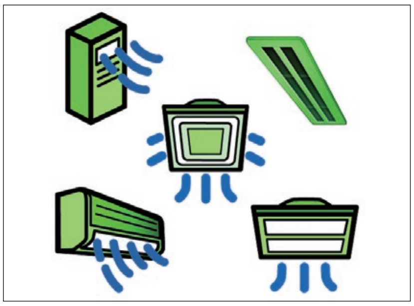
ST

The software can calculate illuminance of various types of light; for example, daylight through an opening of a building and artificial lighting with consideration of its directivity. Object surfaces such as walls are treated as diffusive reflection surfaces. In general, the larger an opening of a building is, the larger heat loss tends to be. By calculating the illuminance, the balance between heat and light can be examined collectively.



Air-conditioner parts (CFD parts) ST

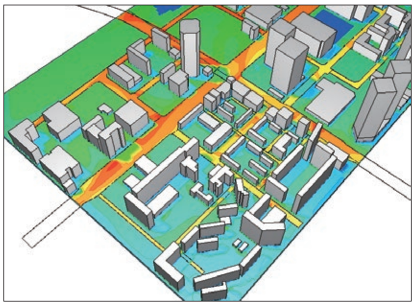
The model shapes of parts frequently used for room air-conditioning can be imported. The models include ceiling cassettes, anemostat models, and linear diffusers. The software can import CFD part data, such as air supply characteristics, provided by SHASE. Various parameters can be set to simulate air-conditioning operation in addition to simple air heating and cooling.



*SHASE: Society of Heating, Air-Conditioning and Sanitary Engineers of Japan

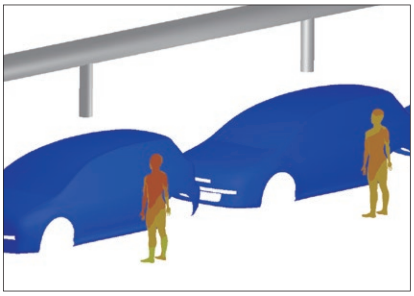
Solar radiation (ASHRAE, NEDO) ST

Climate data published by ASHRAE and NEDO is preset and can be used for condition setting. By entering arbitrary values of longitude, latitude, date, and time, the solar altitude and the azimuth angle of the sun at a specified location and time are calculated automatically. The effect of solar radiation can be examined in detail. Various parameters including absorption and reflectivity of solar radiation and materials which transmit light diffusely, such as frosted glass, can be set.



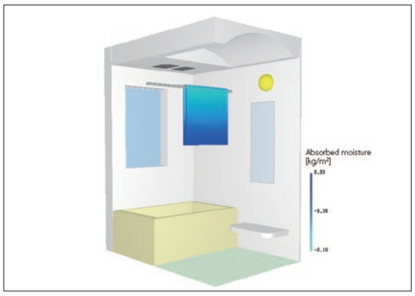
Thermal comfort, heat stress risk and ventilation efficiency indices ST

Comfort indices PMV and SET* can be derived from already obtained temperature, humidity, and MRT (Mean Radiant Temperature), as one of result-processing functions. WBGT (heat stress risk indices), and the scale for ventilation efficiency (SVE), of which some indices can be converted to a real time, can be set by one click, and the range of calculation area can be selected (for example, either one of two rooms).



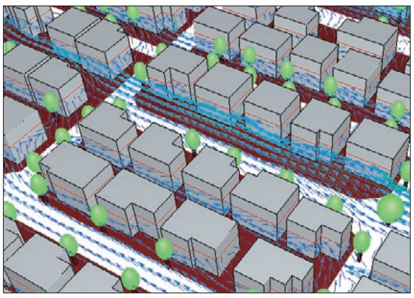
Humidity / dew condensation ST

The software can analyze humidity in the air. Dew condensation and evaporation on a wall surface due to temperature change can be considered and the amount of dew condensation and evaporation per time can be obtained. The software supports the analyses of moisture transfer inside a solid, and the function can be used to analyze a permeable object and dew condensation inside a part.



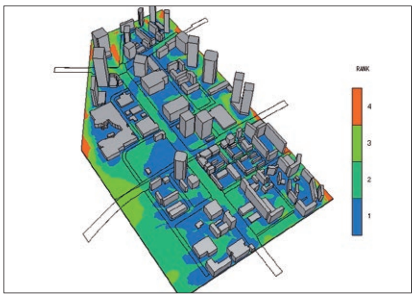
Plant canopy model (flow and heat) ST

Air resistance caused by plant canopy can be considered by setting the coefficient of friction and the leaf area density. For frequently used plants such as oak tree, their parameters are preset as the recommended values. The software also simulates the cooling effect by the latent heat of vaporization on a leaf surface by using the fixed temperature and setting the amount of absorbed heat. The function can be used for analyses of outdoor wind environment and heat island effect.



WindTool (outdoor wind environment assessment tool) ST

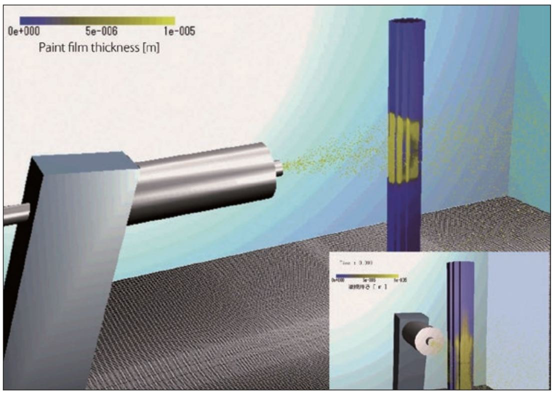
This tool helps assess outdoor wind environment. The assessment criteria can be selected from the ones proposed by Murakami et al. and by Wind Engineering Institute. By specifying a base shape and parameters required for wind environment evaluation, the parameters for 16 directions are calculated and the wind environment is ranked automatically. Detailed distributions of air current and pressure per direction can be visualized.



Electrostatic field

ST

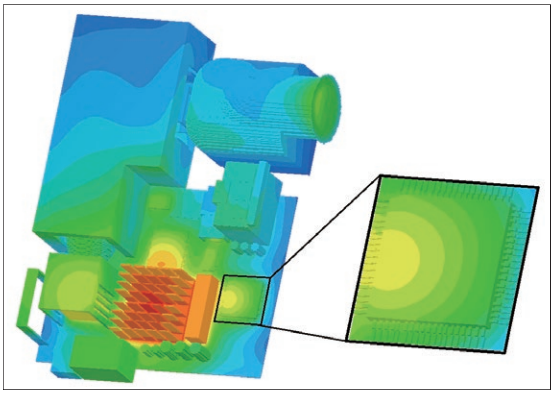
In addition to fluid force, the effect of an electrostatic field, which applies external force to charged particles, can be considered. By setting electric charge of particles and electric potential of a wall surface, the function can be used for analyses to consider area control of electrostatic coating. Velocity at which charged particles do not adhere on a wall surface can also be examined by using the function.



Mapping

ST

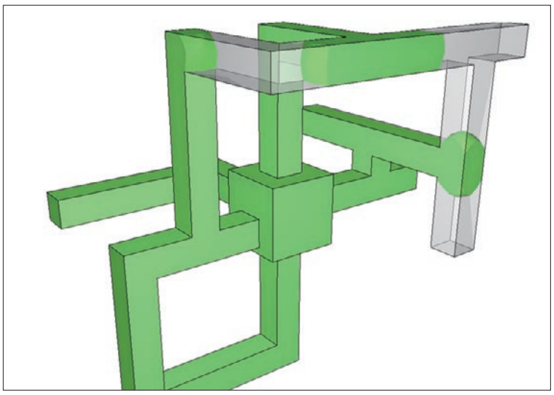
When a target phenomenon is in a small range and the phenomenon is affected by a wide range of its surrounding area, analysis results of the surrounding area can be used for an analysis of the target phenomenon as boundary conditions to decrease the calculation load. To analyze only the inside of an enclosure for an electronic device highly affected by its outside, the analysis results of the outside can be used as boundary conditions.



Flow of foaming resin

ST

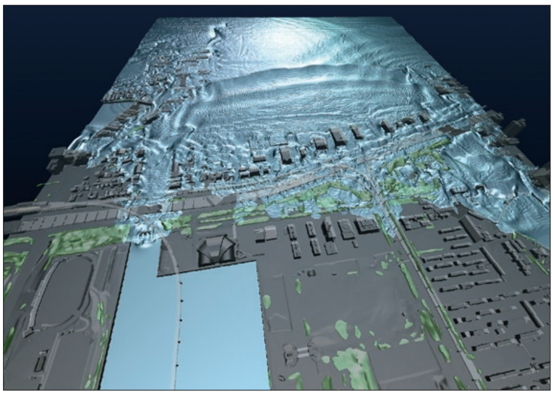
The software calculates the behavior of filling up an object with foaming resin, which is used as a heat insulator for houses and refrigerators. To examine speed and pressure of filling-up and the position for injecting the resin, the software simulates the behavior in 3D. The simulation can provide more pieces of information in shorter time than an actual measurement.



Free surface

ST

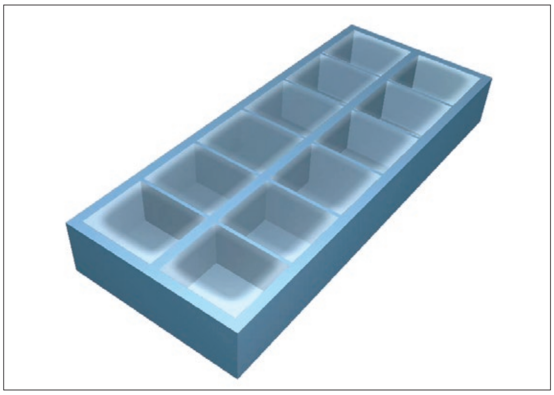
The software calculates the shape of an interface between a gas and a liquid. Either MARS or VOF method can be used, and the calculation target phase can be selected: both gas and liquid, only gas, or only liquid. The function is useful in a wide range of fields: from an analysis of tsunami in the civil engineering and construction field to an analysis of soldering in the electronic device field.



Solidification / melting

ST

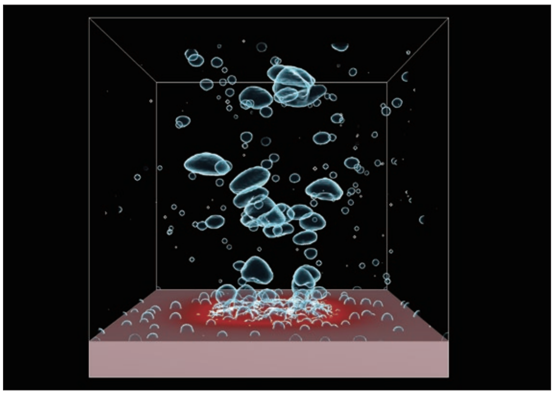
The phase change between fluid and solid, for example, water to ice and ice to water, can be considered. The following phenomena related to solidification/melting can be considered: change of flow affected by a solidified region, change of melting speed depending on the flow status, and latent heat at melting. A phenomenon that water in an ice maker becomes ice can be simulated using the function.



Boiling / condensation (bubble nucleation, bubble growth / condensation)

ST

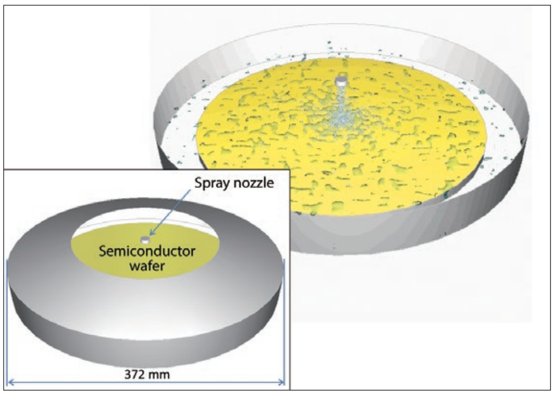
With the function, the user can analyze a boiling flow, which is a gas-liquid two-phase flow caused by temperature difference between a liquid and a heat conduction surface. A boiling flow is analyzed as a free surface analysis using MARS method, and latent heat generation and volume change due to bubble growth / condensation are considered using phase change model.



Particle tracking

ST

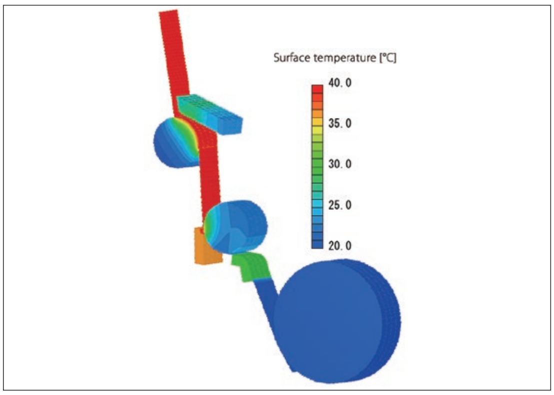
The software simulates the behavior of particles depending on their characteristics (diameter, density, and sedimentation speed) and action/reaction between particles and a fluid. This includes sedimentation due to gravity, inertial force for mass particles, and movement due to electrostatic force, liquefaction at adhering on a wall surface, evaporation and latent heat, the behavior as bubbles in a liquid for charged particles.



Panel (heat conduction / transfer* / thermal transport*)

ST HD

Material properties and motion conditions can be applied to a panel having no thickness in model, which allows for heat conduction to other parts and heat dissipation to air. This enables the simulations of paper feeding and film drying processes, where thin objects move and go under heating repetitively.



* Transfer and thermal transport are only available on scSTREAM

Functions (scSTREAM, HeatDesinger)

			scSTREAM	HeatDesigner
Preprocessor	Modeling	CAD data Interface (import)	Parasolid, STEP, JT, STL, IGES, ACIS, CATIA V6, CATIA V5, CATIA V4, Creo Elements/Pro (Pro/Engineer), SOLIDWORKS, NX, Solid Edge, Inventor, DWG, DXF (2D, 3D-face), 3DM, VDAFS, XGL, IDF, Autodesk Revit, ARCHICAD, BricsCAD, Nastran, SHAPE, 3ds, SketchUp, IFC, PRE, MDL, NFB, Gerber (RS-274D, RS-274X), IPC-2581B, ODB++	Parasolid, STEP, JT, STL, IGES, ACIS, CATIA V6, CATIA V5, CATIA V4, Creo Elements/Pro (Pro/Engineer), SOLIDWORKS, NX, Solid Edge, Inventor, DWG, DXF (2D, 3D-face), 3DM, VDAFS, XGL, IDF, MDL, NFB, Gerber (RS-274D, RS-274X), IPC-2581B, ODB++
		CAD data interface (export)	Parasolid, STL, MDL, NFB	Parasolid, STL, MDL, NFB
		Primitives	Cuboid, hexagon, cylinder, cone, sphere, revolved rectangle, point, panel (orthogonal, quadrilateral), 2.5D solid part, pipe components, fan (flat, axial, blower), electronics (including chassis, thermal circuit model (two-resistor, DELPHI, multi-resistor), fin, slits, Peltier device, heat pipes), air-conditioning appliances (including 4 way cassette, 2 way cassette, wall type, floor type, outdoor unit, anemostat, linear diffuser)	Cuboid, hexagon, cylinder, cone, sphere, point, panel (orthogonal, quadrilateral), 2.5D solid part, pipe components, fan (flat, axial, blower), electronics (including chassis, thermal circuit model (two-resistor, DELPHI, multi-resistor), fin, slits, Peltier device, heat pipes)
		Geometry modification	Boolean operation (sum, subtract, multiply, divide), shape simplification (deformer, filling hole, projection deletion, R fillet deletion), copy, mirror copy, wrapping, solid edit	Boolean operation (sum, subtract, multiply, divide), shape simplification (deformer, filling hole, projection deletion, R fillet deletion), copy, mirror copy, wrapping, solid edit
		Registration of parts library	●	●
	Mesh generation	Tetrahedron	● (finite element model)	
		Hexahedron	● (cylindrical coordinate system)	
		Cuboid	●	●
		Cut-cell	●	
	Conditions	Easy set-up through wizard	●	●
		Preset default conditions	●	●
		Unused dialogs hidden	●	●
		Collective settings to undefined regions	●	●
		Material property library (editable)	●	●
		Laminated materials	●	●
		Absorption-desorption property calculation	●	
	Operation and control environment	VB Interface	●	●
		Selectable mouse operation modes	●	●
		Mapping	●	
		Viewer mode	●	●
Solver	Mesh	Structured mesh	● (Cartesian or cylindrical coordinate)	● (Cartesian coordinate)
		Unstructured mesh	● (finite element model)	
		Multiblock	●	●
		Cut-cell	● (solid, panel, thin shape)	
		Moving objects	●	
		6-degree-of-freedom motion (6DOF)	●	
	Numerical scheme	Finite volume method	●	●
		Pressure correction	SIMPLEC, SIMPLE	SIMPLEC
		Convection term accuracy	1st / 3rd (QUICK / WENO) upwind scheme	1st / 3rd (QUICK / WENO) upwind scheme
		Matrix	MICCG, ILUCR, ILUCGS, FMGCG, FMGCGS	MICCG, ILUCR, ILUCGS, FMGCG, FMGCGS
		Non-linear coupled solver	● (JFNK method)	
		Steady-state / transient calculation	●	●
	Flow types	Incompressible fluid	●	●
		Compressible fluid	●	
		Non-Newtonian fluid	●	
		Buoyancy (Boussinesq approximation)	●	●
		Buoyancy (low-Mach-number approximation)	●	
		Multiple fluids	●	
		Gas mixing	●	
		Foaming resin model	●	
	Turbulence models		Standard k-ε model, RNG k-ε model, MP k-ε model, AKN linear low-Reynolds-number model, MPAKN linear low-Reynolds-number model, Non-linear low-Reynolds-number model, Improved LK k-ε model, Two-equation heat transfer (NK) model (high Reynolds number), Two-equation heat transfer (AKN) model (linear low-Reynolds-number), LES (Smagorinsky, Dynamic Smagorinsky, WALE, mixed-time scale)	Standard k-ε model, AKN linear low-Reynolds-number model
	Thermal analysis	Heat conduction (fluid/solid)	●	●
		Convective heat transfer	●	●
		Heat radiation (view factor method)	●	●
		Heat radiation (flux method)	●	
		Heat conduction panel	●	●
		Solar radiation	● (direct / sky solar radiation / reflection)	
		Lamp (graphic output of rays)	●	
		Joule heat	●	
		Mean radiation temperature calculation	●	
		Global solar radiation calculation	●	
	Diffusion analysis	Diffusivity	●	
		Sedimentation rate	●	
		SORET effect	●	
	Index for ventilation efficiency	Age of air, life expectancy of air, inlet contribution rate	●	
	Thermal comfort index	PMV / SET*/ WBGT	●	
	Illumination analysis	Solar radiation / lamp (graphic output of rays)	●	
	Humidity/dew condensation analysis	Relative humidity / absolute humidity	●	
		Dew condensation	●	
		Humidity transfer in solid	●	
	Reaction analysis	Chemical reaction	●	
		Combustion	● Eddy-dissipation model, PDF (Probability Density Function) method	
	Particle analysis	Marker particles	●	
		Mass particles	●	
		Reactant particles	●	
		Charged particles	●	
		Spray model	●	
		Transforming dew condensation	●	
		Transforming fluid / volume rate	● (MARS method)	
	Discrete element method (DEM)	Contact model	Linear spring dashpot model, Hertz-Mindlin model, Walton-Braun model	
		Cloth model	●	
		Cohesion model	●	
		Thermal	●	
		Ad/desorption (Humidity)	●	
	Multiphase flow analysis	Free surface	● (VOF method, MARS method)	
		Solidification / melting	● (VOF method, MARS method)	
		Boiling / condensation	● (MARS method)	
		Evaporation / condensation	● (MARS method)	
	Current analysis	Conductor current	●	
		Conductor potential	●	
		Braking effect of static magnetic field	●	
	Electric field analysis	Electrostatic field	●	
	Thermal circuit model	2-resistor / DELPHI model / multi-resistor	●	●
	Thermo-regulation model	JOS-2, JOS-3(beta version)	●	
	Optimization	Topology optimization	●	
	Flow conditions	Velocity	●	●
		Power-law velocity	●	
		Volume flow rate	●	●
		Radial volume flow rate	●	
		Pressure (static, total)	●	●
		Natural inflow / outflow	●	●
		Air-conditioner model	●	
		Fan model	●	●
		Wave generation, wave dissipation	● (MARS method)	

Functions (scSTREAM, HeatDesinger)

HEXAGON

			scSTREAM	HeatDesigner
Solver	Thermal conditions	Fixed temperature	●	●
		Heat source	●	●
		Heat transfer coefficient	●	●
		Contact heat transfer coefficient	●	●
	Wall conditions	No-slip (stationary wall)	●	●
		Free-slip (symmetry wall)	●	●
		Log-law condition	●	●
		Power-law condition	●	
		Surface roughness	●	●
		Wall model (LES)	●	
	Pressure conditions	Fixed pressure	●	●
		Pressure loss	●	●
		Porous media	●	
	Source conditions	Volume force / pressure loss	●	●
		Heat source	●	●
		Smoke source (diffusing materials)	●	
		Turbulence generation	●	
		Humidification	●	
		Plant canopy	●	
	User-defined conditions	Variables table / functions	●	●
		Scripts (JavaScript)	●	●
		User-defined function (compilation required)	●	
	Calculation control environment	Job management	●	●
		Monitoring the calculation status	●	●
		Email notification of the calculation	●	●
		VB interface	●	●
	Output post files		Software Cradle post files (FLD, iFLD)	Software Cradle post files (FLD, iFLD)
	Reduced-order model	BCI-ROM	●	
	Output for third party software		Abaqus, Nastran, Femtet, ADVENTURECluster, JMAG-Designer, EMSolution, Optimus, Isight, modeFRONTIER, Autodesk Revit, ARCHICAD, EnSight, FieldView, Adams, Marc, nTop	Abaqus, Nastran, Femtet, ADVENTURECluster, JMAG-Designer, EMSolution, Optimus, Isight, modeFRONTIER, EnSight, FieldView, nTop

			scSTREAM / HeatDesigner
Postprocessor	Drawing functions	Mesh, vector, contour plots	●
		Isosurface, streamline, pathline, volume rendering	●
		Geometry display	● (STL file, NFB file, Wavefront OBJ file)
		2D graph	●
		Mirror / periodical copy	●
		Vortex center	●
	Drawing position / orientation	Arbitrary plane, surface, entire volume, cylinder	●
		Streamlines, isosurface	●
		Pathlines	●
		Arbitrary scaling	●
		Arbitrary pick	● (scalar / vector value)
	Special effects	Oil flow	● (on plane / surface)
		Texture mapping	● (on plane / surface, arbitrary geometry with texture)
		Lighting, luster, gradation	● (preset, arbitrary)
		Transparency, water-like expression, shadow	●
		Ray, Cloth, Surface of particles, Road line, Road line, Heat transfer, IPC-2581	●
		Photorealistic	●
	Animation	Vector animation	●
		Flow line animation	●
		Cut-plane sweeping	●
		Marker particle	● (turbulent diffusion effect)
		Automatic translation of view point	● (view / focus points can be set)
		Key-frame animation, Time line	●
		Animation interpolated between cycles	●
	Analysis results	Variable registration	●
		Integral (surface / volume)	● (scalar / vector integration)
		Comparison	● (clipping function, ,image compare)
		Projected area calculation	●
		Automatic search of the local max / min positions	●
		Import of CSV data	●
		Automatic change of colorbar	● (preset, arbitrary)
		Complex values data graphing	●
	Data image output	Microsoft BMP, JPEG, PNG	● (size, resolution adjustable)
		CradleViewer	● (support steady-state / transient animation, attach to Office applications)
		AVI, WMV, MP4	●
		VRML, FBX, STL, glTF	●
		Copy & paste 3D onto Powerpoint	●
	Operation and control environment	Selectable help function	●
		OpenGL emulation (Hardware acceleration, software rendering)	●
		VB interface	●
		Selectable mouse operation modes	●
		Stereoscopic view (side by side)	●
		Plug-in functionality	●
		Partial open field file by SSH	●
		3D-ROM File reading	●

System Configuration

Product	Compliant OS		CPU, Memory, HDD	Graphics	Approx. size of analysis	Compiler Environment (User defined function)	MPI Library
scSTREAM HeatDesigner	Windows	Windows 10, Windows 11 (Verified by version 21H2, 22H2) Windows Server 2022	**[CPU]** 64bit(AMD64/ Intel64) and AArch64(ARM64)*2 **[Memory]** 8GB or more ; depends on the number of elements **[HDD]** 10GB for installation	**[Graphics]** Graphics card that supports OpenGL for Preprocessor/ Postprocessor	**[Memory]** Approx. 5 million elements/7GB **[Maximum number of elements]** 2 billion **[Maximum degree of parallelism (actual)]** 36864*3	**[Windows edition]** Intel Fortran Compiler Classic and Intel Fortran Compiler for Windows 2024.1 **[Linux edition]** GFortran (GNU Fortran compiler) (Linux standard) **[Linux ARM edition]** GFortran (GNU Fortran compiler) 12.2	**[Windows edition]** Intel® MPI Library 2021 Update 10 or 2018 Update 5*4 **[Linux edition]** Intel® MPI Library 2021 Update 10 or 2019 Update 11*4 **[Linux ARM edition]** OpenMPI 4.1.5
	Linux*1	RedHat Enterprise Linux 8 (Verified by 8.8) RedHat Enterprise Linux 9 (Verified by 9.2) SUSE Linux Enterprise Server 15 (Verified by SP4 and SP5)					

*1 Only compliant with Solver and Monitor. Not available for HeatDesigner.

*2 Only scSTREAM Solver for Linux are supported. Certified CPU : Fujitsu A64FX, Ampere Altra, AWS Graviton3, Certified OS : RedHat Enterprise Linux 8.9. Please contact support when installing on machines equipped with Fujitsu A64FX.

*3 Actual record with parallelism in a subdomain (Upper limit of the number of subdomains is 4096). The maximum number of parallel of the HeatDesigner Solver is 4 (the maximum parallel in a region is 2 and the maximum parallel in a subdomain is 2).

*4 Use Intel-MPI packaged in Cradle products. This version is bundled with Intel MPI 2021 Update 10 and Intel MPI 2018 Update 5(Windows), Intel MPI 2019 Update 10(Linux). We recommend you use Intel MPI 2021 Update 10. When activating on multiple machines, we recommend you use it under the environment that meets the Intel® MPI Library system requirements available at https://software.intel.com/en-us/articles/intel-mpi-library-release-notes (or successor URL).