CST PARTICLE STUDIO(tm)

Technical Specification

1 January 2011

Frontend Module

- For functionality and CAD/EDA import filter, see technical specifications of the CST STUDIO SUITE™

Electrostatics Field Solver Module

- For functionality see technical specifications of CST EM STUDIO®

Magnetostatics Field Solver Module

- For functionality see technical specifications of CST EM STUDIO®

Eigenmode Solver Module

- For functionality see technical specifications of CST MICROWAVE STUDIO®

Particle Tracking Module (TRK)

- Arbitrary shaped particle source surfaces
- Circular particle sources with spatially inhomogeneous current distribution
- Particle interfaces for coupling of tracking/tracking or tracking/PIC simulations
- ASCII emission data imports based on particle interfaces
- Static-, eigenmode- and multiple external field distributions as additional source fields
- Space charge limited, thermionic, fixed and field-induced emission model
- Secondary electron emission
- Tracking in self-consistent fields (gun iteration)
- Analysis of extracted particle current and space charge
- Monitoring of beam cross-section, phase-space diagram and other statistical data of the beam
- Thermal coupling (export of thermal loss distribution from crashed particles)
- Automatic parameter studies using built-in parameter sweep tool
- Automatic structure optimization for arbitrary goals using built-in optimizer
- Network distributed computing for remote computations

- Coupled simulations with Thermal Solver from CST MPHYSICS STUDIO®

Particle in Cell Module (PIC)

- PERFECT BOUNDARY APPROXIMATION (PBA)® for accurate and fast computation of electromagnetic fields in arbitrarily shaped objects
- Isotropic and anisotropic material properties
- Frequency dependent material properties
- Gyrotropic materials (magnetized ferrites)
- Various surface impedance models (tabulated surface impedance, ohmic sheet, lossy metal, corrugated wall, material coating)
- Definable transparency of sheets for particles
- Lumped R, L, C, (nonlinear) diode elements at any location in the structure
- High performance radiating/absorbing boundary conditions
- Conducting wall boundary conditions
- Arbitrary shaped particle source surfaces
- Circular particle sources with spatially inhomogeneous current distribution
- Gaussian-, DC-, field induced- and explosive emission model
- Particle interfaces for coupling of tracking and PIC simulations
- ASCII emission data imports based on particle interfaces
- Static-, eigenmode- and multiple external field distributions as additional source fields
- Secondary electron emission
- Automatic detection of multipaction breakdown
- Definable transparency of sheets for particles
- Port mode calculation by a 2D eigenmode solver in the frequency domain
- Automatic waveguide port mesh adaptation
- Multipin ports for TEM mode ports with multiple conductors
- Inhomogeneous port accuracy enhancement for highly accurate port termination
- Discrete edge or face elements (lumped resistors) as ports
- Time domain monitoring of particle positions and momenta
- Phase space monitoring
- Monitoring of collision information
- Time domain monitoring of output power via waveguide ports
- Monitoring of beam excited fields
- Calculation of field distributions as a function of time or at multiple selected frequencies from one simulation run
- Online visualization of intermediate results during simulation
- Calculation of various electromagnetic quantities such as electric fields, magnetic fields, surface currents, power flows, current densities, power loss densities, electric energy densities, magnetic energy densities, voltages in time and frequency domain
- Single node parallelization

- Network distributed computing for remote computations
- Coupled simulations with Thermal Solver from CST MPHYSICS STUDIO®

Wake Field Module (WAK)

- PERFECT BOUNDARY APPROXIMATION (PBA)® for accurate and fast computation of wake fields in arbitrarily shaped objects.
- Resistive wall wake fields
- Direct and indirect integration schemes
- Cluster Computing with Message Passing Interfaces (MPI)
- Mesh settings for particle beams
- Adaptive mesh refinement in 3D
- Isotropic and anisotropic material properties
- Efficient calculation for loss-free and lossy structures
- Frequency dependent material properties
- Gyrotropic materials (magnetized ferrites)
- Surface impedance model for good conductors
- Lumped R, L, C, (nonlinear) diode elements at any location in the structure
- High performance absorbing boundary conditions - also for charged particle beams
- Conducting wall boundary conditions
- Excitation of fields by ultrarelativistic and non-ultrareletivistic particle beam currents.
- Port mode calculation by a 2D eigenmode solver in the frequency domain
- Automatic waveguide port mesh adaptation
- Multipin ports for TEM mode ports with multiple conductors
- Discrete edge or face elements (lumped resistors) as ports
- Automatic wake-function and calculation
- Automatic wake-impedance, loss and kick factor calculation
- Wakefield postprocessor allows to recompute wake impedances
- Monitoring of beam excited fields
- Calculation of various electromagnetic quantities such as electric fields, magnetic fields, surface currents, power flows, current densities, power loss densities, electric energy densities, magnetic energy densities, voltages in time and frequency domain
- Calculation of field distributions as a function of time or at multiple selected frequencies from one simulation run
- Network distributed computing for parameter sweeps and remote computations
- MPI Cluster parallelization via domain decomposition
- Coupled simulations with Thermal Solver from CST MPHYSICS STUDIO®

Automation

- Automatic parameter studies using built-in parameter sweep tool

- Automatic structure optimization for arbitrary goals using built-in optimizer
- Fully parametric 3D modelling
- VBA macro language
- OLE automation server
- Template based postprocessing

CST Simulation Acceleration

- Acceleration options handled by a token scheme

Documentation

- Handbook "CST STUDIO SUITE™ First Steps"
- Handbook "CST PARTICLE STUDIO® - Getting Started and Tutorials"
- Handbook "CST STUDIO SUITE™ Advanced Topics"
- Online Help System

Minimum Hardware Requirements

- Intel® Xeon® based PC, 4GB RAM, DVD-Drive, at least 20 GB of free hard disc space.
- Fully OpenGL compliant graphic card
- Windows XP Professional, Windows Vista, Windows 7
- All solvers support RedHat Enterprise Linux (RHEL) 4.x und 5.x.
- Hardware recommendation depends on your application. If in doubt, please contact your local sales office for further information.

General

- CST PARTICLE STUDIO® is a configurable tool with a choice of 6 solver modules. The standard configuration is one full process with the electrostatics field solver module, the magnetostatics field solver module, the particle tracking mocule (TRK), and one additional frontend. Floating and node-locked licenses are available. Please contact your local sales office for further information.