

FloEFD™ Release Highlights

Software Version FE18.0.0

December 2018

**Unpublished work. © 2018 Mentor Graphics Corporation
All rights reserved.**

This document contains information that is confidential and proprietary to Mentor Graphics Corporation, Siemens Product Lifecycle Management Software Inc., and their affiliates (collectively, "Siemens"). The original recipient of this document may duplicate this document in whole or in part for internal business purposes only, provided that this entire notice appears in all copies. In duplicating any part of this document, the recipient agrees to make every reasonable effort to prevent the unauthorized use and distribution of the proprietary information.

Note - Viewing PDF files within a web browser causes some links not to function.

This document is for information and instruction purposes. Siemens reserves the right to make changes in specifications and other information contained in this publication without prior notice, and the reader should, in all cases, consult Siemens to determine whether any changes have been made.

The terms and conditions governing the sale and licensing of Siemens products are set forth in written agreements between Siemens and its customers. No representation or other affirmation of fact contained in this publication shall be deemed to be a warranty or give rise to any liability of Siemens whatsoever.

SIEMENS MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

SIEMENS SHALL NOT BE LIABLE FOR ANY INCIDENTAL, DIRECT, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING BUT NOT LIMITED TO LOST PROFITS) ARISING OUT OF OR RELATED TO THIS PUBLICATION OR THE INFORMATION CONTAINED IN IT, EVEN IF SIEMENS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

U.S. GOVERNMENT LICENSE RIGHTS: The software and documentation were developed entirely at private expense and are commercial computer software and commercial computer software documentation within the meaning of the applicable acquisition regulations. Accordingly, pursuant to FAR 48 CFR 12.212 and DFARS 48 CFR 227.7202, use, duplication and disclosure by or for the U.S. Government or a U.S. Government subcontractor is subject solely to the terms and conditions set forth in the license agreement provided with the software, except for provisions which are contrary to applicable mandatory federal laws.

TRADEMARKS: The trademarks, logos and service marks ("Marks") used herein are the property of Siemens or other parties. No one is permitted to use these Marks without the prior written consent of Siemens or the owner of the Mark, as applicable. The use herein of a third- party Mark is not an attempt to indicate Siemens as a source of a product, but is intended to indicate a product from, or associated with, a particular third party.

The registered trademark Linux® is used pursuant to a sublicense from LMI, the exclusive licensee of Linus Torvalds, owner of the mark on a world-wide basis.

Introduction

This document provides a high-level summary of this release. It includes a summary of the new features in this release, any authorization code changes required, any major installation changes, and any transitioning issues you should be aware of before installing. Additionally, any last minute issues found in the final stages of testing are included.

New Features

The following new features are available in this release.

Thermal Management and Electronics Cooling

- **Batteries.** The new Battery compact model calculates the heat dissipation rate based on the electrical or electrical-chemical characteristics of the battery cell. Two models are supported:
 - The Equivalent Circuit model represents a cell as a second-order resistor-capacitor (2RC) equivalent circuit model. The model inputs are OCV (open circuit voltage), resistance and capacitance values as functions of SOC and temperature.
 - The Electrochemical-thermal coupled model simulates thermal and electrochemical behaviors of the battery cell. Requires chemical properties of electrolyte.The obtained heat dissipation rate is applied to the cell. The state of charge, voltage, current and the temperature distribution are predicted (requires *Power Electrification* module).
- **Calibration.** The thermal transient measurement of electronics packages can be performed with MicReD® T3Ster® hardware test equipment. The obtained package characteristics represent the true package internal structure and material properties. However the package characteristics used in simulation can differ with the reality due to lack of knowledge about the internal structure. The new Calibration mode in the Parametric Study searches for package dimensions and material properties to fit the measured data (requires *T3STER Auto Calibration* module and T3Ster hardware test equipment).
- **Smart PCB.** A new Smart PCB feature represents a PCB as a Network Assembly with a large number of nodes. The network assembly is constructed from the layer images providing precise conductivity and capacity map of the PCB's internal structure. The Smart PCB also allows importing effective conductivity map as a *.csv or *.trmexport file (requires *EDA Bridge* module).
- **Flux Plot.** With the new Flux plot capability you can display how much heat goes from one component to another (by conduction) as a graph. You can also display the heat transfer to fluid (convection) and via radiation. Components can be grouped so the heat is calculated as total heat for all components grouped. The Pie chart for incoming and outgoing heat helps to understand the balance of heat.

-
- **Improved EDA Bridge.** IPC2581 (Rev B) and IDX (Prostep) formats are now supported. A new method to calculate effective thermal conductivity based on empirical data is added (requires *EDA Bridge* module).
 - **Fan operating point.** You can display the fan operating point on the fan curve in the graphics area. Right-click a fan condition and select “Show Operating Point”.
 - **Component Explorer: Edit Materials, Two Resistors, LEDs.** The Component Explorer allows you to list material and source conditions applied to components in one table. You can now easily change materials, LEDs, Two Resistors, as well as edit material properties and heat generation rate values for multiple components right from the table.
 - **Contact resistance with a unit "K/W".** For the thermal contact resistance you can now set integral (K/W) resistance values and FloEFD automatically recalculates and applies the specific value based on the area of surface contact.

Radiation and Lighting, Film Condensation

- **LED: Luminous Flux and Heat Generation Rate linked goals.** You can now create linked goals for the Luminous Flux and the LED Heat Generation Rate (requires *LED* module).
- **Radiation: Flux measure on semi-transparent surfaces.** Quantification of incoming radiation flux on semi-transparent surfaces is now possible.
- **Radiation: On-Orbit radiation.** For a spacecraft orbiting a celestial body (a planet or a moon), the main sources of environmental heating are direct sunlight, sunlight reflected by the celestial body (albedo), and the infrared (IR) energy emitted by the celestial body itself. Such on-orbit radiation can now be simulated for a given celestial body and orbital characteristics. All planets and the moons are pre-defined in the database (requires *ADVANCED* module).
- **Radiation: Coating Surface.** You can set a radiative surface with defined emissivity to a surface of a semi-transparent solid. In such a case the surface becomes non transparent emulating a phenomenon such as metal coating on semi-transparent media (requires *LED* module).
- **Radiation: Setting Radiation Temperature other than the global Environment Temperature for a specific wall.** A new “Wall to environment wall” type of radiative surface allows setting for a particular surface a radiation environment temperature other than the global one defined in the General Settings. This type of condition can be used in case different sides of the model undergo radiation with different environment temperatures.
- **Solar radiation direction is visualized to account loaded time moment.** You can visualize the direction of solar radiation at the loaded time moment.

-
- **Film motion.** For fogging/defogging analysis you can optionally consider water film motion on surfaces due to gravity and aerodynamic forces (Water Film requires *LED* or *ADVANCED* module).
 - **Radiation: Absorption/emission in gases.** Thermal radiation can be emitted/absorbed by H₂O and CO₂ fluids in combustion analyses (requires *ADVANCED* module).
 - **Thermal NO formation.** For a combustion analysis you can estimate the mass fraction of non-equilibrium Nitric Oxide (NO) based on Thermal-NO (Zeldovich-NO) model. The Thermal NO mechanism is a predominant source of NO_x in gas flames at temperatures above 1800 K (requires *ADVANCED* module).

Productivity

- **Cut Plot: Plot normal to curve.** You can create cut plot normal to a curve. While animating the plot moves along the curve. This new option makes creating a section along the centerline of a tube or circular channel much easier.
- **Surface Parameters: Evaluate in sections, link to cut plot.** Surface parameters can now be calculated in a section plane, not only on geometry surfaces. Earlier in order to measure parameters in a section you had to create an auxiliary body and disable (make fluid) it before the calculation. Now you can just select a plane, planar face or curve (a section will be created normal to the curve) to calculate local and integral parameters in the section. In addition, you can select Cut Plot and Surface parameters will be linked to the location of the cut plot. If a section plane divides the model into several closed contours, parameters can be calculated separately for each contour.
- **Flow Trajectories: Start from simple shapes (line, rectangular) rather than geometry reference.** Flow Trajectories can start from linear or rectangular virtual objects (not a CAD geometry), which you can interactively move, rotate, and resize in the graphics area.
- **Comparing different models in FloEFDView.** With the Compare feature you can easily compare results of different projects of the same model. The new FloEFDView (a free viewer of FloEFD results) allows you to compare results of different models. To be comparable the results must be based on the same Scene template and saved in FloEFD View file format (*.efdscene). When opened in FloEFDView such results can be synchronized for orientation, plot visibility and pallet's minimum and maximum values. You can display and synchronize results of many models.
- **Scene template.** To compare results of different models with FloEFDView an *.efdscene file must be created from the scene template for all the models you are going to compare. You can create scene templates from individual plot or the whole scene (a scene consists of all currently displayed plots). To create templates from a plot, right click the plot icon in the tree or, for the scene template, show all plots, right-click the Results folder and select **Create Scene Template**.
- **Scene in Batch Results Processing.** The Batch results Processing feature creates multiple images for different projects and models. You can now create a FloEFDView

3D image (including XY plots and Goal charts) from a scene template for multiple models and projects using the Batch Results Processing.

- **Apply to all selected project in Batch Results Processing.** The “Apply to all selected project” option creates results (images, reports, tables) for all the selected projects automatically (you do not need to open each project and select the corresponding plots).
- **Pin dialog while creating a condition.** You can now pin an input data dialog while creating a condition. When you click OK in the pinned dialog, the condition is created but the dialog does not close, the selection is cleared and you are ready to create another condition. This small enhancement allows saving a lot of time while creating multiple conditions of the same type.
- **Custom Visualization Parameters: Add logical expressions.** You can display plots for various pre-defined parameters. In case the default list of parameters is not enough, in the Engineering database you can create your own visualization parameter derived from the pre-defined parameters. In the formulae definition of a custom visualization parameter you can now use logical expressions such as IF, OR, XOR, AND, NOT, NA (not available or undefined), “more than” (>), “less than” (<). With such parameters you can get much more information from the calculated field. For example, IF({Surface Heat Flux }>10, {Temperature (Solid)}, 0) returns the value of solid temperature when the value of the surface heat flux is higher than 10 (in SI units) and returns 0 if the surface heat flux value is equal to 10 or lower. When evaluated with the Surface Parameters such parameters can calculate an area where a desired parameter is greater or smaller than the specified value.
- **Improved geometry variation in Parametric Study.** For maximum flexibility in varying geometry parameters you can now select the existing CAD Equation as input variables in the Parametric Study.
- **Parameters.** A project parameter is a user defined constant or variable which can be used for definition of boundary conditions throughout the project. You can use parameters in dependencies and vary parameters in the Parametric Study.
- **API improvement (create project from template, create face based (color or name) conditions).** With API (available for C++, VBA, VBS) you can create scripts to automate your workflow. You can now create a project from template and create various boundary conditions such as materials, sources, openings, radiative surfaces, fluid subdomains, etc. A volume boundary condition (such as material property) is created using the name of component or body. A face-based boundary condition (such as radiative surface) is created using a face name or color. You can also attach a face condition to the active face selection. With the ability to edit project data and get results, the new API can be used to create highly automated workflows.
- **Template name for boundary conditions.** Using the “Name Template” you can now define the condition name at creation.
- **Feature Goals.** For Boundary Conditions, Sources, Electrical Conditions, Fans, LEDs, Two Resistors, and Batteries features you can create linked goals directly from the

condition dialog. This goal is linked to the condition, so changing the reference in the condition updates the reference in the goal. Removing the condition will remove the corresponding goal. For example, when you define a pressure opening condition, you can create the Mass Flow Rate goal on this opening surface with just one click. Likewise, you can set a Maximum Temperature goal for a component when applying a heat source to it.

- **Improved geometry handling default state.** The default state of the “Improved geometry handling” option can be set under Flow Analysis, Tools, Options. This option toggles between using CAD Boolean and FloEFD Boolean for retrieving fluid and solid bodies from the CAD model. If selected, FloEFD Boolean is used, also for creating a project with the Wizard.
- **Offset option in XY Plots.** This option is only applicable for the XY plots located on the solid-fluid interface (wall). If this option is selected and the “Interpolate” option is not selected, FloEFD takes the parameter values in the centers of fluid volumes of solid-fluid boundary cells, i.e. in the first fluid volumes from the wall. If the “Interpolate” option is selected, the parameter values from centers of fluid volumes are interpolated to the location of the XY plot by the standard interpolation procedure. If the “Offset” option is not selected, the XY plot shows the values of parameters at the wall (e.g. the velocity at the surface of a non-moving wall is always equal to zero).
- **Display computational domain size.** The project Summary (accessible from Project, Edit, Summary) contains the size of Computational domain in the X, Y, Z directions (distances between the minimum and maximum coordinates).
- **OneSim.** OneSim is a tightly coupled co-simulation workflow that enables a FloEFD model to be considered as part of a FloMASTER® network. One or more FloEFD hydrodynamic boundary conditions are nominated for linking to the FloMASTER network. Once connected, a simulation instigated from within FloMASTER will solve both the FloEFD model and the FloMASTER network concurrently, until steady state or transient convergence. Flow rates, pressures and fluid temperatures will be communicated through the linked boundary conditions / hydraulic nodes throughout the solution process (requires *FloMASTER v9.1* product).
- **Embedded HEEDS.** A new design exploration option in the Parametric Study allows access to the efficient and robust optimization/search SHERPA algorithm from HEEDS™ embedded into FloEFD. This design exploration functionality simultaneously leverages multiple global and local search strategies, and adapts the search as it learns more about the design space. It requires no algorithmic search expertise on the part of the user, but easily incorporates user intuition through its collaborative search capabilities. This process allows you to identify higher-performing families of designs with minimal simulation time and cost (requires additional *Embedded HEEDS* module).

Authorization Codes

No changes to authorization codes are required for this release. You may request your existing authorization codes by opening a non-technical Service Request on Support Center.

<https://support.mentor.com>

For additional information on licensing, refer to the Mentor Graphics Standard Licensing manual.

Licensing

This release uses the Mentor Graphics Standard Licensing v2018_1 (patch 2). If you use floating licenses, you will need to update the license server accordingly. If you see an error message that says vendor daemon is too old, that is usually an indicator that the license server needs to be updated to run this version of the client software. For additional information on licensing, refer to the Mentor Graphics Standard Licensing Manual.

Installation Information

For additional information on installation, refer to the Installation Instructions manual and the Help system within the installation software. You can view this manual in the Manual directory at the top level of the DVD.

Support Information

If you have questions about this software release, please log in to Support Center. You may search thousands of technical solutions, view documentation, or open a Service Request here:

<https://support.mentor.com/>

If your site is under a current support contract but you do not have a Support Center login, register today:

<https://support.mentor.com/register>

Supported Platform

- Microsoft Windows 7 Professional, Ultimate or Enterprise 64-bit edition, Windows 8, Pro or Enterprise 64-bit, Windows 10 Pro or Enterprise 64-bit (tested with v1803)
- For solver: Microsoft Windows 2012 Server x64, Windows 2012 Server R2 x64, Linux RHEL 6.6, RHEL 7.3, Windows Server 2016 with HPC Pack 2016, Linux SUSE SLES 11 SP3, SUSE SLES 12 SP0
- Microsoft Office 2013, Microsoft Office 2010, Microsoft Office 2007
- Microsoft Windows Media Player 7.0 or higher
- Ethernet network adapter
- Mouse or other pointing device
- DVD-ROM drive
- 4 GB RAM minimum, more recommended
- 6 GB of free hard disk space, more required for simulation models