

Multiphysics for IronCAD 2018: new technologies, enhancement and updates

Since the unveiling of Multiphysics for IronCAD, the usability and robustness of MPIC have been appreciated by many users. Each year, additional improvement and refinement have been added to further increase the ease of use and the functionality. Most of these new features are based on the user feedback and request to speed up design cycle, simpler analysis, and faster analysis times.

In MPIC 2018, we have included several key technologies designed specifically for CAD design analysis. We focus on general CAD designers and users who want to adopt design analysis earlier in the digital prototyping cycle, and aim to provide accurate, realistic and quick analysis. As such, most of these improvements are in the assembly analysis functionalities.

MPIC 2018 New Technologies and Features

- A new automatic tie/glue is now available for assembly analysis. In assembly parts, some may have intentional gaps or overlapping for welding or thermal expansion/shrinkage, or there may be other unintentional openings/interference. A general analysis usually require these parts be glued and meshed accordingly, and may take too much user efforts or not feasible. The auto-tying solves this problem by meshing these parts as separated meshed bodies, and then apply the MLS (Moving-Least-Squares) constraint to glue these parts as one connected assembly for analysis.
- There is no longer any assembly model size limitation, as long the there are enough memory to store these CAD parts. Previously, once there are more than 1000 parts, the first showing of the MPIC parts menu is very slow, and could be more than a few minutes. The new MPIC2018 now displays these large FE parts in seconds, or almost instant for most models.
- For easier CAD assembly analysis, new two-way display synchronization between the analysis model and the CAD assembly model is now available. Previously, the user can hide assembly parts of no design interest, and select the synchronization button to inform the analysis to skip these parts in analysis. In MPIC 2018, a new “Show only analysis parts” feature is now available to display only those parts are active in the design analysis.
- A new fatigue cycle analysis option is now available in the Dynamic module. This allows the design engineer to easily predict the life cycle of parts using the built-in fatigue material data. The conventional stress-life method is used, and the user can either choose to enter the experimental S-N curve data, or the fatigue parameters.
- Based on popular user request, a new user-defined customized unit system is now available. For different applications require and prefer different default unit, the user can now define a new customized unit definition and re-call it later in any model without customizing it again each time.
- A new hydrostatic pressure loading boundary condition is available to simulate the pressure loading of the submerged behavior of solid parts without using the actual assigning the external fluid domain. User should assign the free surface level of the fluid and the gravitational direction, and the static hydro pressure will be automatically applied to all specified solid surface based on the surface normal direction.
- Better meshing support for models that may have intended/unintended gaps in assembly. That usually will generate a finer and more uniform mesh as compared with the previous version.
- MPIC/AMPS multithread formulation has been further refined to take advantage of all single/multiple CPU cores of the latest Intel 8th generation processor, Core X-series processors, Xeon Scalable processors and the new AMD Ryzen processors. It also takes full advantage of the lower latency local cache and smarter prefetch with fast thread pooling and lock-free thread synchronization technology for maximum computing throughput.
- MPIC model is now upgraded to XMD 2.0 model and compatible with all AMPS product lines. It can be opened, modified, and analyzed by any AMPS XMD application if additional features/capabilities are needed.

MPIC 2018 Product Update Enhancements

- The ribbon bar interface has been redesigned to facilitate faster and more convenient model creation, selection, display controls.
- The Analysis Report module can now be localized for different local language. The needed localization part is stored inside xmd_report64.dll.
- New contact pressure calculation now gives higher accuracy in contact pressure prediction. Previously, the contact analysis Lagrangian Multiplier value along with the contact area estimation were used to compute the contact pressure, and result in much higher contact pressure as the contact tributary area calculation were sensitive to the convergence status. The new formulation now always computes contact pressure based on the final converged state.
- Enhanced stabilization process for tiny, bad or extremely thin/small element due to bad geometry or fast load stepping.
- For controls/menus limited by licensing privilege, they are now in grey color rather than just as blank hidden space. User data are also further checked to prevent invalid data entry such as 0.5 Poisson's ratio.
- Enhanced frequency domain solver now can use virtual memory/Windows swap space when the computer memory is not enough. This is useful as the frequency domain solver uses complex number storage for deformation magnitude/phase, and the memory requirement is large than the regular static/dynamic analysis.
- Enhanced multithread controls with better computing efficiency for computers now commonly with larger amount of CPU cores. The latest update now raises all computing threads to have "above normal" priority to have better system clock cycles, and also has a better system busy handling algorithm to increase computing efficiency and stability without the thread racing problem. When multiple threads are accessing the same resources, it uses a proprietary "yield spinning" algorithm without raising any system interrupt calls that may slow down the computing speed.

Changes

- A new electric license is now available for model with electric physic. Electric module license is now needed to analyze electrical current/potential, dielectric distribution, Joule heating, etc. For user subscribing to MPIC 2017 maintenance support, the electrical license will be automatically included.
- Starting from 2018, the old ADATA/ASIMS formats are no longer used. Only the unified XMD model data are stored and used for consistency with all AMPS product lines.

Fixes

- Sine/Cosine time function for loading and boundary condition now saves, reads and displays correctly.
- Updated meshing component to better handle small feature in solid model, and for better support of assembly model meshing.
- Refined error reporting for anisotropic/orthotropic material data for erroneous or inconsistent Poisson's ratio information.
- User selected unit system is now the default unit for result processing.
- Centrifugal/Acceleration load scaling display is now consistent with actual data.

MPIC 2018 SP1 updates and fixes, February, 2018

- Stiffened Modal analysis license checking is now corrected.
- Previous models with fluid physics are converted properly into 2018 format without warning.
- Localized MPIC and Analysis Report will now work properly without warning message.
- Product installation now updates all files when there is a previously installed version.

MPIC 2018 PU1 updates and fixes, May, 2018

- Added product update and new version availability information to remind users of important product updates and support.
- Improved equation solver to better handle models with near singular/unstable/nonlinear state.
- User defined unit system now checks and reject any user-defined data with zero or negative scaling.

- Corrected model data import from MPIC2017 version not displayed properly. The model transition is correctly migrated, but the model information in several boundary condition types such as Rigid Rotation is not displayed properly.
- Constraint and Load time function are now migrated correctly for models using non-default setting.
- Fixed model data nonlinear thermal dependency display error when retrieving from a saved model with nonlinear thermal dependency for thermal radiation emissivity, thermal conductivity, fluid viscosity, and electrical conductivity. The saving process has been correct, but the reading and re-display was corrupted.
- Fixed material thermal reference temperature, volumetric heat generation, and shell thickness data are not restored properly.
- Fixed centrifugal and global acceleration loading time function as it was always using default setting when model is re-opened.
- Model analysis title is now saved/restored properly.
- Fixed nodal damping, nodal stiffness and nodal mass boundary condition time scaling when non-default time function is used.
- Fixed the setting of electrical surface flux boundary condition erroneously restored as wrong type.
- Updated several help file chapters missing proper picture/image due to HTML help file compilation issues.