

Multiphysics for IronCAD 2019: new technologies, enhancement and updates (PU1 update 4/11/2019)

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 user feedback and request to speed up design cycle, simplify analysis setup, and reduce analysis times.

In MPIC 2019, 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 2019 New Technologies and Features

- The latest release includes the rigid body kinematic (RBK) function that is most suitable for Sefea finite element simulation. For assembly design analysis, the mixing of rigid body and finite element allows critical regions to be assigned as finite element domain for accurate Sefea multi-physics analysis with non-crucial parts or connecting mechanism assigned as rigid bodies to transmit the constraint/load/motion needed for an integrated assembly analysis. The design analysis will solve faster and allow further refinement on the crucial regions of interest.
- Based on popular user request, we have added options for result contour coloring controls. Each color band can be individually assigned, as well as the total amount of contour colors.
- For result review, we have added the optional maximum/minimum labeling option to the result display option so user can easily find the critical region easily.
- Better meshing support for models that may have intended/unintended gaps in assembly; with the goal of generating 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 2.3 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 2019 Product Enhancements

- The material database now contains more than 500 different commonly used material data. If desired, user can expand/customize the material database by adding to the included material data spread sheet.
- 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.
- When conjugated flow and thermal heat transfer analyses are active, and optional “least-squares thermal” option is now available for better convergence support when the problem is extremely nonlinear. The default diffusion heat transfer formulation remain the same.

MPIC 2019 updates and fixes

- 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.
- Corrected model data import from previous version. 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.
- Fixed remote tying data in tie/glue boundary condition issue as they were not converted when importing from earlier MPIC2014 version.
- Update the fluid inflow/outflow boundary condition so the default pressure is not always applied when model is retrieved.
- Enhanced user interface to fix an issue in legacy Windows 7 that sometimes decimal number are neglected or interpreted erroneously.

MPIC 2019 PU1 updates and fixes

- Enhance the auto-tying feature such that loose parts with large gap can be automatically tied as one connected body. User can control this tying tolerance control by enlarging the default tying gap from 5% of the mesh size to as large as 100% or larger for a quick analysis and design review.
- Fix a material library access to properly review all library data not just those previously used.
- Update the default licensing scheme so the evaluation and starter licenses will include the new rigid-body-kinematic license.
- Update the result contour unit setting so it is always the same as user’s unit.
- Update the equivalent strain formulation with a scaling factor of 2/3 so it matches the commonly used uni-axial stress and strain definition.
- Update the default Joule heating energy conversion constant so the default setting is 100% electrical to thermal energy conversion.
- Update meshing capability to better handle thin layer parts.