AIM Frequent Releases

Provides rapid expansion of capabilities

R16.0
- Essential physics for fluids, structures, thermal, and electric conduction
- Static/steady state, modal
- Single, easy-to-use user environment
- SCDM and DX

R16.1
- UX improvements
- Structural joints
- Conjugate heat transfer (Beta)
- Compressible flow (Beta)
- Stress-life fatigue (Beta)
- Custom templates (Beta)

R16.2
- Conjugate heat transfer
- Compressible flow
- Buoyancy
- Nonlinear contact
- Large deflection
- Stress-life fatigue
- One-way thermal FSI
- Custom templates
- Enhanced graphics
- Auto-region interfaces (Beta)
- Integrated design points (Beta)

R16.1
- UX improvements
- Structural joints
- Conjugate heat transfer (Beta)
- Compressible flow (Beta)
- Stress-life fatigue (Beta)
- Custom templates (Beta)

R17.0
- Integrated modeling
- Material rendering
- Integrated design points
- Auto-region interfaces
- Enhanced solution monitoring
- Remote loads
- Strain-life fatigue
- Field level help
- AIM on simulation portal
- Student licensing
- UX improvements
- Magnetostatics (Beta)
- Model transfer to Mechanical and Fluent (Beta)

R17.1
- Magnetostatics
- Magnetic-thermal coupling
- Polymer extrusion
- Structural shells
- Solution monitors
- Performance
- Material appearance settings
- Geometry modeling enhancements
- Multi-step templates
- UX enhancements
- AIM included with Mechanical Enterprise
- Thermal transients (Beta)
- Model transfer to Mechanical (Beta)

R17.2
- Simulation steps and bolt pretension
- Thermal transients
- Momentum and heat sources
- Periodic interfaces
- Wall roughness
- Viscosity as a function of strain rate
- Monitoring calculated values
- Extrusion with thermal effects
- Model transfer to Mechanical
- Japanese user interface
- UX enhancements
- HTML report generation
- Magnetic frequency response (Beta)

R18.0
- Magnetic frequency response
- One-way magnetic-thermal coupling
- Solver dependent expressions (Fans)
- More structural boundary conditions
- Display Multiple Results
- Display Calculated Values
- Shell FSI
- Model transfer to Fluent
- Scripting for Geometry
- UX Enhancements
- Chinese user interface
- AIM included with Fluids Enterprise Products
- Fluids Transient (Beta 2.0)
- Porous media (Beta)
AIM 18.1 New Features

- Fluids
  - Porous medium
  - Boundary layers
  - Post-process solution residuals and mesh quality

- Structures
  - Bi-linear isotropic hardening plasticity
  - Enhanced solver messages
  - Enhanced solver file management

- Magnetics
  - Temperature dependent material properties and temperature condition
  - One-way thermal-magnetic coupling
  - Enhanced conservative mapping for losses

- General
  - AIM home page
  - Guided simulation
  - In-context apps
Porous Medium

- Isotropic porous medium on bodies (Orthotropic available as beta)
- Specify viscous and inertial resistance coefficients to control momentum loss or volume porosity
- Model fluid flow through filters, perforated plates, packed beds, flow distributors, etc.

Flow through an exhaust manifold including an orthotropic porous medium
Boundary Layer

- Inflation mesh control renamed Boundary Layer
  - Intuitive name improves ease-of-use for defining mesh controls

Exhaust manifold mesh with boundary layers
Fluids Solver Enhancements

- Enhanced fluid solver convergence, which is less sensitive to the number of parallel processes.
- Improved robustness for fluid solution automatic initial guess when the model setup includes both pressure inlets and outlets, supersonic outlets or mixed (supersonic/subsonic) inlet boundary conditions.
- Enhanced HPC scaling for conjugate heat transfer solutions via physics based partitioning.
Display Mesh Quality and Solution Residuals

- Ability to post-process mesh quality metrics and solution residuals for fluids solutions
  - (Execute one solution iteration to post-process mesh quality.)

- Allows evaluation of mesh quality and solution residuals in regions where solution is struggling to converge.

Display of orthogonal quality

Display of velocity x residual
Nonlinear Structural Materials

- Bi-linear isotropic hardening plasticity
- Specify yield stress and tangent modulus
- Material assignment controls use of plasticity model
- Simulate yielding and stress distribution of structural components

Equivalent plastic strain in an over loaded battery contact
Enhanced Solver Messages for Structural, Thermal and Electric Conduction

- Enhanced solver messages for solver failure, warnings or errors
  - “Negative Pivot” style messages removed
- New troubleshooting section provides guidance for common issues
- Simpler to debug solver and model setup issues

Troubleshooting Structural, Thermal, and Electric Conduction Simulations

In some cases, your structural, thermal, or electric conduction simulation may not converge, or may be subject to element distortions, exaggerated distortions, disk space errors, or other issues. The following sections address recommendations for the following issues:

- Solver engine unable to converge
- Element distortions
- Large deformations in comparison to the model bounding box
- Insufficient disk space errors
- Errors when starting to solve
- Unable to find requested modes
- Internal solution magnitude limit exceeded
- Iterative solver required excessive number of iterations to converge
- Large deformation results active
- License manager server down

Additional information is also available in the Contact Best Practices section.

New enhanced solver messages and troubleshooting guidance
Enhanced Solver File Management for Structural, Thermal and Electric Conduction

- All solver files are deleted after solution
  - With the exception of solver files required for solution restarts

- **Significantly reduces size of AIM project files**

![Bar chart showing project file size reduction](chart.png)

*Project file size reduced by an average of 75% for a variety of structural models.*
Temperature Dependent Materials for Magnetics

- Temperature dependent properties for electric conductivity, relative permittivity and relative permeability
  - Specify with an expression or tabular data

- Body Temperature condition
  - Specify temperature on solid bodies for magnetostatic or magnetic frequency response solution

- Improves accuracy for devices operating at high temperatures

Body temperature applied to coil geometry
One-way Thermal-Magnetic Coupling

- One-way thermal-magnetic coupling
  - Transfer volumetric temperature from thermal simulation to a magnetostatic or magnetic frequency response simulation
  - Builds capability towards two-way magnetic-thermal coupling

Temperatures and current density in a planar transformer solved with one-way thermal-magnetic coupling
Enhanced Heat Rate Mapping

- **Volume element intersection algorithm**
  - *No scaling factor* required for heat rate conservation
  - New default option
  - Improves accuracy of thermal solution for one-way magnetic-thermal coupling

*Scaled nearest element uses large scale factor to enforce conservation of heat rate, non uniform temperatures*

*Volume element intersection enforces conservation without scale factor, uniform temperature results*
Magnetics Template Enhancements

• New option to include electromagnetic effects due to solid heating
  – Enables thermal-magnetic coupling
• Selecting magnetic frequency response automatically adds Skin Depth Resolution
  – Only location needs to be specified
• Improves usability of magnetics template
AIM Home Page

• Launch templates and custom apps, resume existing projects, access help and define simulation workflows

• More modern start-up experience
Enhanced Simulation Templates

- Simulation Templates now include multiple steps to define workflow
- Geometry Modeling automatically launched when required
- Improves ease-of-use of templates

Simulation Templates now include multiple steps, and geometry modeling is automatically launched when required.
Add Simulation Template after Geometry Creation

- New workflow allows simulation template to be executed after geometry creation or import.
  - Available for both native and CAD connected geometry
- Simplified workflow to add simulation to existing geometry for mesh refinement studies, FSI and other linked simulations, etc.

Start with Geometry Modeling to create or import geometry

After creating geometry click on “Add Simulation”

Select desired Simulation Template to create simulation workflow
Modeling includes Faceting Tools

- Modeling includes faceting tools for organizing, modifying and smoothing faceted geometry for simulation.
- Enables geometry creation from STL files, scan data, etc.
Export Residuals/Monitors to CSV File

- Export solution residuals and/or monitors to CSV file, to enable additional processing
  - For example data analysis using Excel
- Zoom chart to see the most recent 200 points during a solution to refine the view
  - Easier to visualize convergence trends
Guided Simulation

• Custom applications with a persistent, guided workflow
  – Enables users to move back and forth in app

• Provides easy-to-use apps for users who do not need to access the full AIM UI.

Guided Simulation for linear buckling analysis
In-Context Custom Applications

- Launch in-context apps from right-click context menu.
  - “Guide Me” provides access to in-context apps
- Provides greater flexibility for creating custom applications for specific functions.

In-context app for automatically specifying Boundary Layers based on a defined wall boundary condition.
AIM 18.1 Beta Features

- Beta features can be activated by selecting Tools > Options > Appearance
- Beta features can be uniquely turned on or off by selecting Tools > Options > AIM
- For more information consult the AIM Beta Documentation available on the Customer Portal