ANSYS AIM 16.0
Overview

AIM Program Management
Today’s Simulation Challenges

• Leveraging simulation across engineering organizations
• Gaining simulation insights across multiple physics
• Process Compression and Knowledge Capture
• Modeling real world conditions
• Producing rapid and dependable results with maximum use of computing investment

Introducing: ANSYS AIM 16.0
AIM is an integrated solution for 3D engineering simulation encompassing the breadth of ANSYS physics in a single, modern user environment.
Simulation for Every Engineer

Engineering Challenges

• Effective design decisions require understanding of multiple physics

• Desire to leverage simulation early in the design process, but resource limited

• Many simulation tools have steep learning curves and are not suitable for occasional users

AIM Solution

• AIM is Multiple and Multiphysics, by design

• Templates and guided workflows enable every engineer to rapidly obtain meaningful results

• Customization and scripting tools allow experts to automate complex simulation solutions for their entire organizations
One Window, All Physics

Engineering Challenges

• Simulation-driven processes require complex workflows through multiple environments
• Learning simulation for a new physics is like learning a new language
• Silos between engineering groups are reinforced by use of separate tools

AIM Solution

• A single user environment designed for complete 3D engineering simulation to drive product development
• A common, intuitive, customizable user experience across all aspects of simulation
• Consistent workflows and user experience for seamless collaboration and reuse of data across Multiple and Multiphysics simulations
Process-Defined Solutions

Engineering Challenges

- Product development processes are as unique as products, but traditional software often dictates those processes.
- Knowledge of engineering and simulation best practices can be difficult to automate and deploy.
- Simulation tools are most effective when embedded in design systems.

AIM Solution

- Flexible workflows can be constructed based on the tasks and needs of each type of simulation.
- Designed for the deployment of customized simulation workflows to engineering groups.
- Built upon a native journaling and scripting language which enables all simulation steps to be recorded, customized, and replayed.


**Model the Real Environment**

**Engineering Challenges**

- Specification of real world conditions can be limited by simple, single-valued inputs
- Need for rapid evaluation of multiple design alternatives under a range of environments and conditions

**AIM Solution**

- Any input value or result can be defined via an expression to capture known conditions
- AIM is fully parametric and includes the necessary tools for rapid design exploration to investigate the entire operating environment
Proven, High Performance Simulation

Engineering Challenges

- Engineers want reliable and dependable results to allow rapid exploration of their design spaces
- Businesses need to maximize utilization of investments in parallel computing to obtain fast simulation results

AIM Solution

- AIM includes proven, accurate solver technology for multiple physics and multiphysics, with over forty years of continuous technology development
- All aspects of AIM (mesh generation, solution and post-processing) take advantage of today’s parallel computing architectures
ANSYS AIM

Physics Capabilities of AIM 16.0

- Steady-state fluid flow and heat transfer
- Static structural analysis
- Modal analysis
- Thermal conduction
- Electric conduction
- Thermal-stress
- Thermal-electric
- Thermal-electric-stress
- One-way FSI
Guided Simulation Process

- Templates provide automation and ease-of-use
  - Simulation templates provide task-based workflows that guide users through their simulation processes

A simulation template creates a task-based workflow from geometry import through results post-processing for a fluid-structure interaction simulation of an exhaust manifold.
Geometry Preparation with SpaceClaim

- **SpaceClaim included with AIM**
  - Geometry import from both CAD and neutral sources
  - Geometry simplification and defeaturing
  - Fluid volume extraction
  - Static geometry parameterization

Geometry imported from multiple sources, sliver surfaces removed from model, and fluid volume extracted for a butterfly valve assembly using SpaceClaim.
Model Configuration

- Import geometry from all major MCAD systems, SpaceClaim, and DesignModeler
- Configuration task allows imported geometry to be configured and/or suppressed for meshing and subsequent simulations

Butterfly valve model configured for fluid-structure interaction simulation; original imported geometry from SpaceClaim and configured fluid and structural geometries shown.
Meshing for All Physics

• Automated and user-defined mesh resolution based on engineering intent
  – Tetrahedral meshing with inflation
  – Hexahedral meshing

• Parallel mesh generation

  CFD mesh for external flow

  Structural mesh for static analysis
Fluid Physics

- Fluid physics capabilities
  - Steady-state, single-phase flow
  - Laminar and turbulent flows
  - Flow and heat transfer

Velocity streamlines through a butterfly valve

Pressure on a cut plane through flow control valve

Velocity streamlines over a rear spoiler
Structural Physics

- Structural physics capabilities
  - Linear static analysis
  - Modal analysis
  - Thermal-stress analysis

Clutch housing and frame, deflection and first principal stress from static loading
Thermal Physics

• Thermal physics capabilities
  – Steady-state thermal conduction
  – Convection and radiation boundary conditions
  – Thermal-stress analysis
  – Thermal-electric analysis
  – Thermal-electric-stress analysis

Temperature in finned heat sink

Heat flux vectors through package, thermal grease layer and heat sink
Electric Physics

- Electric physics capabilities
  - DC electric conduction
  - Thermal-electric analysis
  - Thermal-electric-structural analysis

Current density, temperature and equivalent stress in fuse element
Fluid-Structure Interaction

- One-way fluid force transfer from fluid to structural physics
  - Accurate mapping of both normal and tangential fluid forces

Deformation in butterfly valve based on fluid forces from steady-state flow solution.
Visualization

• Integrated post-processing for all physics
  – Contours, vectors, iso-surfaces, and streamlines
  – GPU and parallel CPU post-processing
  – Calculated values and expressions for quantitative output

*Contour plot of displacement magnitude*

*Pressure on isosurface of constant velocity magnitude*

*Velocity vectors*
HPC

- All calculations are parallel
  - On local machine
  - Mesh generation
    - Simultaneous part meshing for assemblies
    - Uses all available cores by default
  - Physics solution
    - 2 processes included at no extra cost
    - Supports ANSYS HPC Parallel Packs
  - Post-processing
    - Data analysis for iso-surfaces, etc.
Design Exploration

- **DesignXplorer included with AIM**
  - Design point studies, design of experiments and robust design

*Design of experiments solution for a thermoelectric cooler and package assembly, temperature and current density shown for base TEC design.*
Powerful Expression Language

• Full use of expressions
  – All model inputs can include expressions

Specify a velocity profile on inlet boundary condition using autocomplete with a previously-defined named expression.
Integrated, context-sensitive and video-based Help System
Automation and Customization

- Full journaling and scripting
- Record, customize, replay and reuse simulation data via native, Python-based scripting
- Templates
- ACT extensions
AIM Frequent Release Schedule
Rapidly Expands Simulation Capabilities

AIM 16.0
Essential Capabilities

AIM 16.1
Increased Breadth and Depth

AIM 16.2
Increased Breadth and Depth
ANSYS AIM

*Simulation for Every Engineer!*

- Immersive user experience
- Guided workflows
- Multiple physics
- Multiphysics
- Automation and customization
- Design optimization
ANSYS AIM
Simulation for Every Engineer!