Ansys Mechanical Getting Started

Module 04 Reference Guide: Geometry, Materials, and Coordinate Systems

Release 2023 R1

Please note:
- These training materials were developed and tested in Ansys Release 2023 R1. Although they are expected to behave similarly in later releases, this has not been tested and is not guaranteed.
- The screen images included with these training materials may vary from the visual appearance of a local software session.

Module 04: Learning Objectives

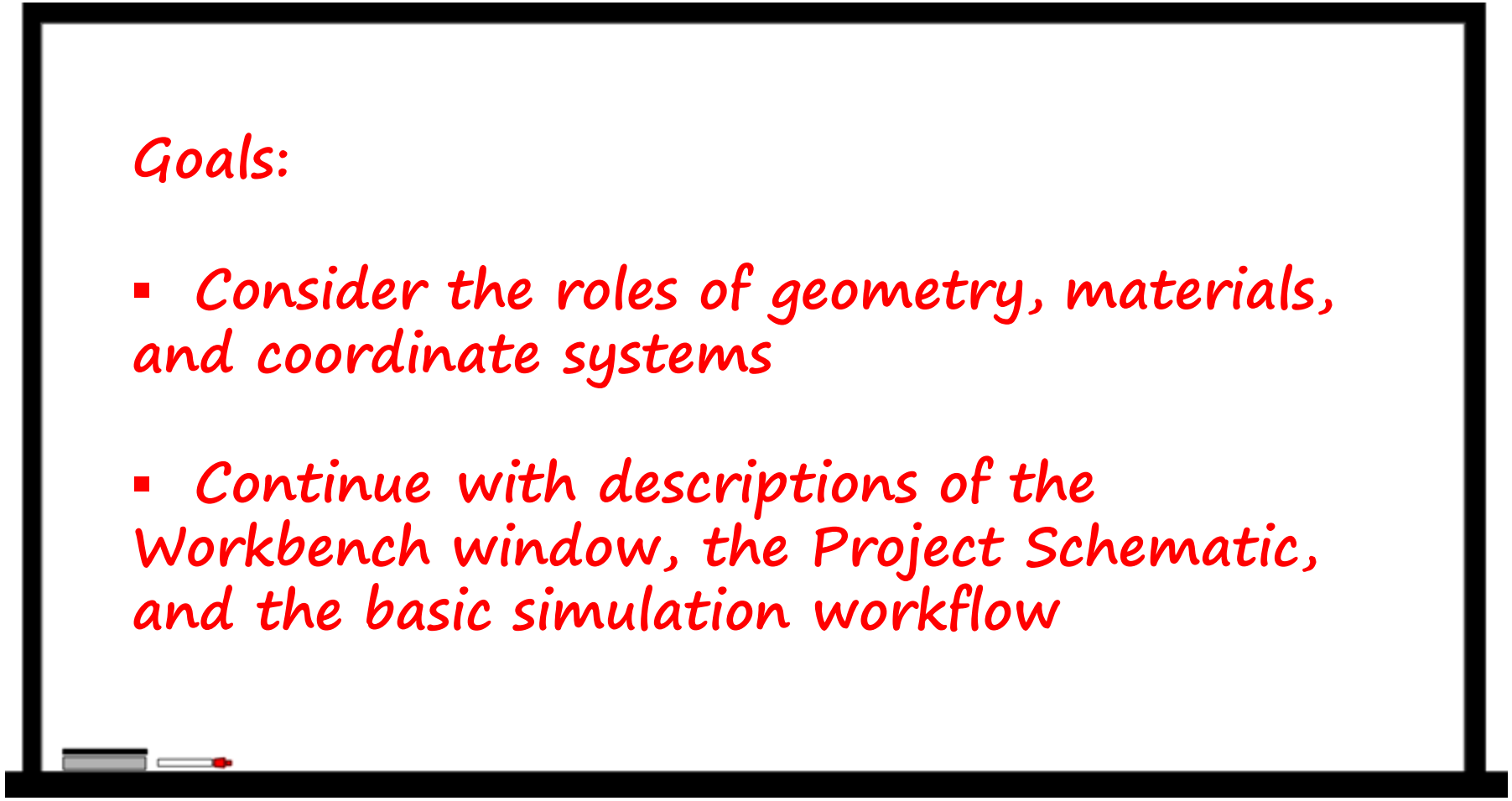
In this module, we will gain a general understanding of the simulation workflow:

- Engineering Data
- CAD Import

And we will review the first features in the Mechanical Outline Tree:

- Material Assignment
- Stiffness Behavior
- Coordinate systems

Module 04: Graphics

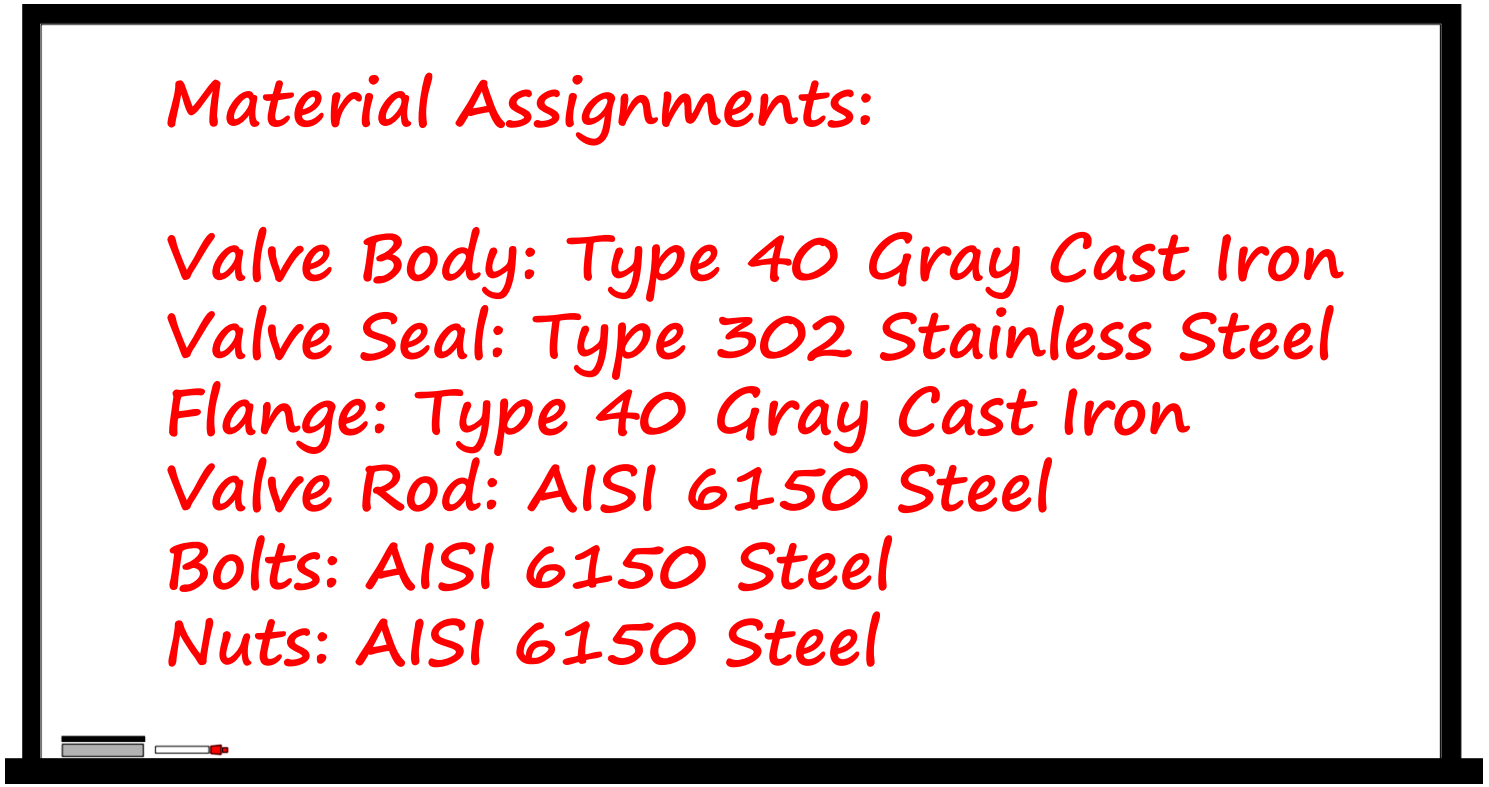


Module 04: Agenda

The following are included in the instructor demonstration:

- Workbench Workflow
- Engineering Data: description of material library and creation of a new material model
- CAD import
- Material assignments
- Choice of Stiffness Behavior
- Coordinate Systems creation

Module 04: Reference Material



Module 04: Reference Material

Module 04: Reference Material

- These are links to supporting reference and background information for topics from this module. Unless noted otherwise, they will require authenticated access to the Ansys Help System or to the Ansys Customer Portal.
- **The Workbench Toolbox**

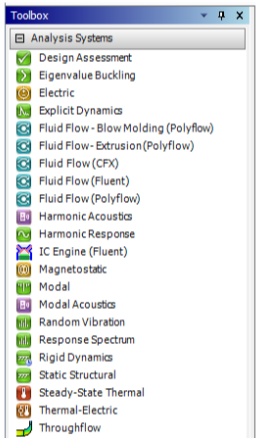
Toolbox Pane

Located in the **Project** tab, the **Toolbox** pane contains the types of data you can add to your project.

To add data, you take the systems located in the **Toolbox** pane and add them to the **Project Schematic** pane.

Systems are divided into categories which can be expanded or collapsed to show or hide the systems in that category. You can select systems from the following categories:

- Analysis Systems
- Component Systems
- Custom Systems
- Design Exploration



Module 04: Reference Material

- **The Workbench Project Schematic**

Adding Systems to the Project Schematic

In the **Project** tab, you take systems from the **Toolbox** and add them to the **Project Schematic**. Projects can vary in complexity, from a single system representing all the necessary steps for a desired analysis, to a complex set of connected (linked) systems representing coupled analyses or variations in modeling approaches.

> **Note:** We recommend that a project contain only systems that are relevant to a specific analysis or coupled analysis with a well-defined focus. Adding systems for multiple unrelated analyses to the same project can have an adverse effect on performance and cause corruption with portions of the project.

Most analysis systems are defined by three primary attributes: physics type, analysis type, and solver type. Workbench uses these attributes to determine valid data transfer and system replacement possibilities. For more information on the types of systems, see Working Through a System.

Related topics:

- System Placement
- Adding a System by Double-Clicking
- Adding a System using Drag-and-Drop
- Adding a System using the Context Menu
- Adding Multiple Independent Systems
- Creating Connected Systems

Module 04: Reference Material

- **Project Schematic System Cell States (Status Icons)**

Understanding Cell States

Workbench integrates multiple applications into a single, seamless project flow, where individual cells can obtain data from and provide data to other cells. As a result of this flow of data, a cell's state can change in response to changes made to the project. Workbench provides visual indications of a cell's state at any given time with icons on the right side of each cell.

Typical Cell States

State	Icon	Description
Unfulfilled		Required upstream data does not exist. Some applications may not allow you to open them with the cell in this state. For example, if you have not yet assigned a geometry to a system, all downstream cells appear as unfulfilled, because they cannot progress until you assign a geometry.
Refresh Required		Upstream data has changed since the last refresh or update. You may or may not need to update output data. When a cell is in this state, you can edit the cell, refresh the data, update upstream components, or update the cell. The advantage to refreshing rather than updating a cell is that you are alerted to potential effects on downstream cells and make any necessary adjustments before you update it. This option is especially useful if you have a complex system in which an update could take significant time and computer resources.
Attention Required		All of the cell's inputs are current. However, you must take a corrective action to proceed. To complete the corrective action, you may need to interact with this cell or with an upstream cell that provides data to this cell. Cells in this state cannot be updated until the corrective action is taken. This state can also signify that no upstream data is available, but you can still interact with the cell. For instance, some applications support an "empty" mode of operation in which it is possible to enter the application and perform operations regardless of the consumption of upstream data.
Update Required		Local data has changed and the output of the cell must be updated.

Module 04: Reference Material

- **Project File Management**

Saving and Managing Project Files

The file management system in Workbench stores several different files under a single project, using directory trees to organize files relevant to each system and the applications used in the system.

When the project file (**<*filename*>.wbpj**) is created, Workbench creates a project folder named **<*filename*>_files** where <*filename*> is a name you provide. All files relevant to the project are saved within this folder.

The primary subdirectories within the project folder are **dp0**, **dpall**, and **user_files**.

We strongly recommend that you use caution when directly modifying any of the content in any of the Workbench project directories or subdirectories other than **user_files**. You should work through the Workbench user interface to manage your project as much as possible. Workbench may not recognize or be aware of any changes that you make directly in the file system (such as adding or removing a file).

> **Important:** If you are resuming a project in Mechanical on the Linux platform, there is a restriction that the path to the project, as well as the project name, include ASCII characters only, otherwise, the project cannot open.

Module 04: Reference Material

- **The Workbench Units Menu**

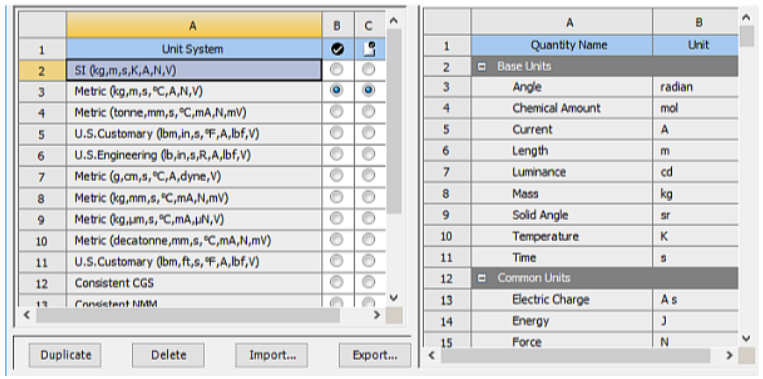
Configuring Units in Workbench

Workbench provides:

- Predefined unit systems that contain the most commonly used sets of units.
- The ability to define custom unit systems based on the predefined unit systems. (You cannot edit or delete predefined unit systems.)
- The ability to display the following project data using the project unit system:
  - Engineering data
  - Parameters
  - Charts.
- The ability to share the unit system between users.

> **Note:** Unit settings in Workbench are not passed to Fluid Flow analysis systems; to CFX, Fluent, **Results**, or TurboGrid systems; or to FSI: Fluid Flow custom systems.

To open the **Unit Systems** dialog box, from the menu bar select **Units** > **Unit Systems**.



Module 04: Reference Material

- **Engineering Data Overview**

Overview

Engineering Data is a resource for material properties used in an analysis system. Engineering Data can be used as a repository for company or department data, such as material data libraries. The Engineering Data workspace is designed to allow you to create, save, and retrieve material models, as well as to create libraries of data that can be saved and used in subsequent projects and by other users.

The following topics cover the basics of the Engineering Data workspace:

- Definitions
- User Interface

Module 04: Reference Material

- **Discovery Pull Tool**

Pulling a Solid

1. Click the Move tool.
2. Select the face you want to move.
3. Use the Move handle to move the face.
   The solid is extended in the direction of the move

Module 04: Reference Material

- **Mechanical Tree Outline Overview**

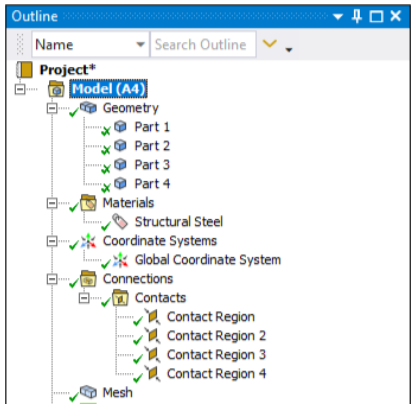
Outline

Go to a section topic:

- Outline Pane Overview
- Context Menu Options
- Object Details
- Additional Capabilities

Overview

You use the **Outline** pane, as illustrated below, to set up your model using the "objects" arranged in the tree structure. These objects guide you through the different steps of a simulation. By expanding the objects, you expose the details associated with the object, and you can use the corresponding tools and specification tables to further define your simulation. Refer to the Objects Reference section for a listing and description of all of the objects available in the application.



Module 04: Reference Material

- **Mechanical Worksheet Overview**

Worksheet Window

The worksheet presents you with information about objects in the tree in the form of tables, charts and text, thereby supplementing the Details view. It is typically intended to summarize data for a collection of objects (for example, the **Connections** folder worksheet reveals the inputs for all contacts, joints and others) or to receive tabular inputs (for example, to specify the coefficients and the analyses to include in **Solution Combinations**).

Behavior

- **Dockable Worksheet**

  By default, when you select an applicable object in the tree, a dockable**Worksheet** window displays alongside the **Geometry** window, allowing you to review both at once. You may, however, disable the display of the **Worksheet** window using the **Worksheet** option (see below). This preference is persisted in future sessions of the product. There are specific objects that ignore the preference, as outlined below.

Worksheet Function	Worksheet Behavior When Object is Selected	Example Objects
Data input and display information	Automatically appears and gains focus	**Constraint Equation**, **Solution Combination**
Display information related to object settings	Automatically appears but does not gain focus	**Analysis Settings**
Display information related to objects within a folder	Appears only if display is turned on manually using the **Worksheet** option (see below)	**Geometry** folder, **Contact** folder

Module 04: Reference Material

- **Coordinate Systems Overview**

3.3. Coordinate Systems

The following coordinate system topics are available:

- Understanding the Element Coordinate System
- Elements That Operate in the Nodal Coordinate System
- Solution Coordinate Systems

3.3.1. Understanding the Element Coordinate System

The element coordinate system is used for:

- Orthotropic material input
- Pressure loading input on certain faces of the surface effect elements
- Output of element quantities, such as stresses, strains, and thermal gradients

A default element coordinate system orientation is associated with each element type. In general, these systems are described below. Elements departing from this description have their default element coordinate system orientation described in Element Library.

Element coordinate systems are right-handed, orthogonal systems.

End of presentation