INTRODUCTION

By default, all parts are assigned to the same frame of reference. You can, however, create additional coordinate frames and assign parts to them. These frames (and the parts assigned to them) can be manipulated (rotated, translated, scaled) independently of other frames. Some examples of frame usage:

1. You wish to create a **copy** of a part and display a different variable on the copy. When you create the copy, a new frame is automatically created and the copy is assigned to it. The new frame can be translated away from the original to visualize both variables simultaneously.

2. You wish to create an animation of parts moving independently (*e.g.* for an exploding view or to "open" a closed object with a "hinged door"). Each dynamic part is assigned to a new frame. During **keyframe animation**, the frames are manipulated independently to achieve the desired motion.

3. You have a dataset with **rotational periodicity** but the symmetry axis is not aligned with a major axis. A new frame is created and positioned such that it's Z axis is aligned with the symmetry axis.

4. You have a dataset that makes correct positioning of EnSight tools difficult, *e.g.* a duct not aligned with a major axis. Create a new frame and align one of the axes with the duct. Since tool positions are always specified with respect to the current frame, you can now use the Transformation Editor to accurately position tools along the axis of the duct.

In addition to position and orientation, frames have a number of display attributes such as visibility, line width, and color. You can also specify the length of each axis separately and display a series of evenly spaced labels to use as a 3D measuring tool.

Frames are a powerful but complex feature of EnSight. Understanding the basics of frames is essential for proper use. This article is divided into the following sections:

BASIC OPERATION

Introduction

On startup, EnSight creates a default frame – frame 0 – located at 0,0,0 of the right-handed "world" or model coordinate system and aligned with the X, Y, Z axes. All parts (model and newly created) are assigned to frame 0 initially. Frame 0 is special in that it *cannot* be repositioned or deleted.

Note: Frame mode is reserved for the expert user. By default, it is not enabled. To enable it, go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.

Frames are selected either by clicking the frame axis triad (while in Frame mode) in the Graphics Window or by selecting the frame in the "Which Frame" list of the Transformation Editor dialog. Any frame operation (such as setting attributes) acts on the currently selected frames.

The EnSight positioning tools (Cursor, Line, Plane, and Quadric tools) are always positioned *with respect to the currently selected frame*. If more than one frame is selected, frame 0 is the reference frame for tools. If you have tools visible, you will notice them changing position as the selected frame is changed.

EnSight implements computational periodicity (such as rotational symmetry) as an attribute of frames. If a frame has symmetry enabled, all parts assigned to the frame will be duplicated as specified by the particular type of symmetry.

All frame axis triads are visible when in Frame mode. The axis triad consists of three lines representing the X, Y, and Z orientation vectors plus labels. Selected frames are colored with the default highlight color (typically green). If the frame is visible (meaning it will be displayed in all modes) the frame axes are drawn with solid lines. Otherwise, dashed lines are used.

EnSight does not support hierarchical frames: you cannot assign a frame to another frame to implement nested transformations. All frames are embedded in the same world coordinate system (*i.e.* frame 0).

Create a New Frame

In general, you have to explicitly create new frames. However, EnSight will automatically create a new frame each time you create a copy of a part and assign the copy to the frame.

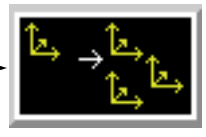
To create a frame:

1. **Click Frame in the Mode Selection area to enter Frame mode.**

   (Note: If Frame does not appear as an available mode, first go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.)

   The initial position of a new frame can either be set to 0,0,0 or automatically centered on a set of parts.

2. **If desired, select one or more parts in the Main Parts list – the new frame will be centered on the selected parts.**

3. **Click the New Frame icon to create the frame.** 

The new frame also becomes the currently selected frame.

Select Frames

There are two ways to select frames. You can click on the frame axis triad in the Graphics Window or select frames in the "Which Frame" list in the Transformation Editor dialog. Selected frames are colored with the default highlight color (typically green).

To select frames in the Graphics Window:

1. **Click Frame in the Mode Selection area to enter Frame mode.**

   (Note: If Frame does not appear as an available mode, first go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.)

2. **Position the mouse pointer over the frame axis triad (the lines – not the XYZ labels) and click the left mouse button.**

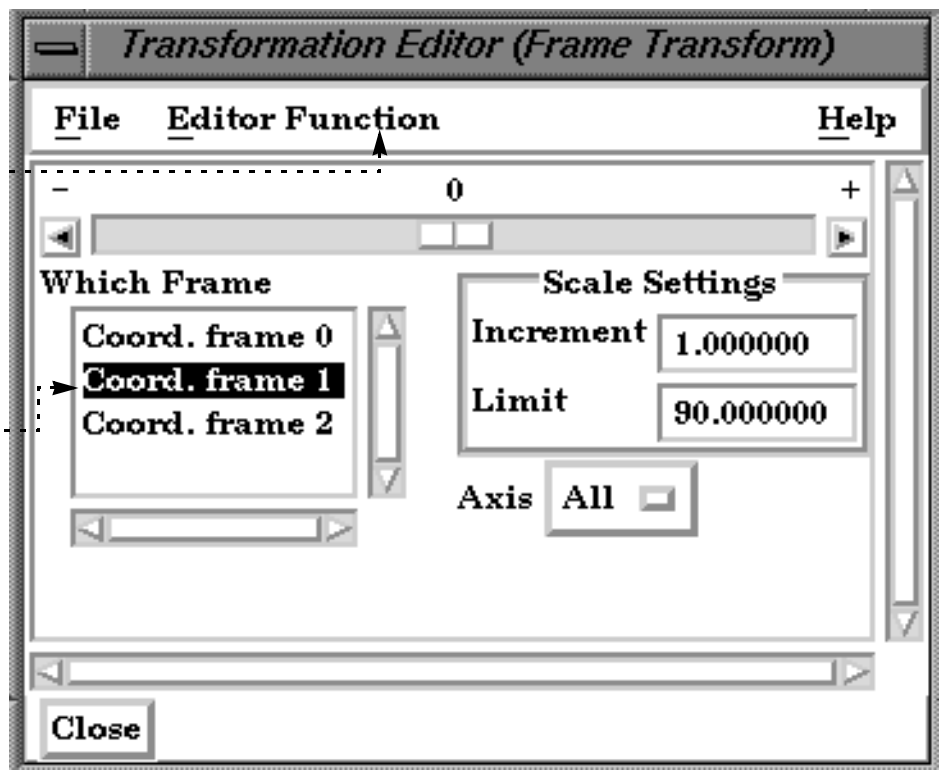
You can extend a selection of frames by holding down the Control key as you click on frames.

To select frames using the Transformation Editor dialog:

1. **Click the Transf. Edit ... icon in the Transformation Control area to open the Transformation Editor dialog.**

2. **Select Frame > Transform from the Editor Function menu. Note that this puts EnSight into Frame mode.**

3. **Select the desired frames in the Which Frame list.**



You can use standard Motif list selection techniques, such as shift-click to extend a selection or control-click to de-select an item.

The Which Frame list is also displayed if the Editor Function menu is set to one of the Tool modes (*e.g.* Tools > Cursor).

Assign Parts to Frames

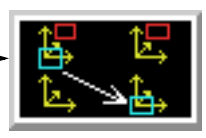
To assign a part to a frame:

1. **Click Frame in the Mode Selection area to enter Frame mode.**

   (Note: If Frame does not appear as an available mode, first go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.)

2. **Select the desired part(s) in the Main Parts list.**

3. **Select the desired frame (as described above).**

4. **Click the Part Assignment icon to assign the part(s) to the frame.** 

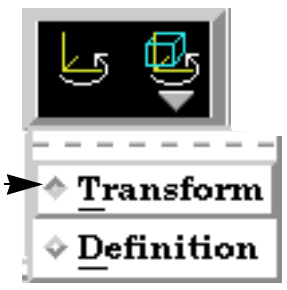
A message is printed to the Status History area confirming the assignment.

Move and Rotate Frames

You transform a frame (and all parts assigned to it) when you perform any transformation while in *Frame Transform mode*. Frame Transform mode is set automatically when you enter Frame Mode. You can also set it explicitly from the Editor Function menu in the Transformation Editor dialog.

To transform in Frame Transform mode:

1. **Click Frame in the Mode Selection area to enter Frame mode.**
   (Note: If Frame does not appear as an available mode, first go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.)
2. **Select Transform from the Transform/Definition pull-down.**



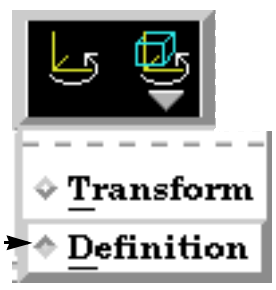
3. **Select the desired frame(s) (as described above).**
4. **Perform the desired transformation either interactively (using the Transformations Control icons and the mouse in the Graphics Window) or via the Transformation Editor dialog. See How To Rotate, Zoom, Translate, and Scale for more information.**

Frame transforms are implemented as a transformation applied with respect to the frame's position and orientation. At times you will need to modify the position and orientation of the frame independent of the parts assigned to it. This is done while in *Frame Definition mode*. You enter Frame Definition mode either explicitly from the mode menu in the Transformation Editor dialog (Editor Function > Frame > Definition), or via the Transform/Definition pull-down icon while in Frame Mode.

Important! You cannot change the frame definition if you have performed any frame transformations (if you attempt to do so, a dialog will remind you). Any frame definition must be applied prior to a frame transformation. If you have already made frame transforms you can clear them by returning to frame transform mode and using the Reset Tools and Viewports dialog (click Reset... to open).

To transform the Frame Definition:

1. **Click Frame in the Mode Selection area to enter Frame mode.**
2. **Select Definition from the Transform/Definition pull-down.**



3. **Select the desired frame(s) (as described above).**
4. **Perform the desired transformation. This can be done either interactively (with the mouse in the Graphics Window) or via the Transformation Editor dialog. To translate the frame interactively, move the mouse pointer into the Graphics Window and click and drag the left mouse button. To rotate the frame interactively, click and hold the left mouse button on one of the frame axes and drag the mouse. Clicking on the X axis will rotate the frame about its Y axis. Clicking on the Y axis will rotate the frame about its X axis. Clicking the Z axis will rotate about both X and Y. Use the Transformation Editor dialog to rotate about the Z axis only.**

You can also edit the frame's definition explicitly using the Transformation Editor dialog:

1. **Click Frame in the Mode Selection area to enter Frame mode.**

(Note: If Frame does not appear as an available mode, first go to Edit->Preferences..., select General User Interface and toggle on Frame Mode Allowed.)

2. **Click the Frame Location Attributes icon.**

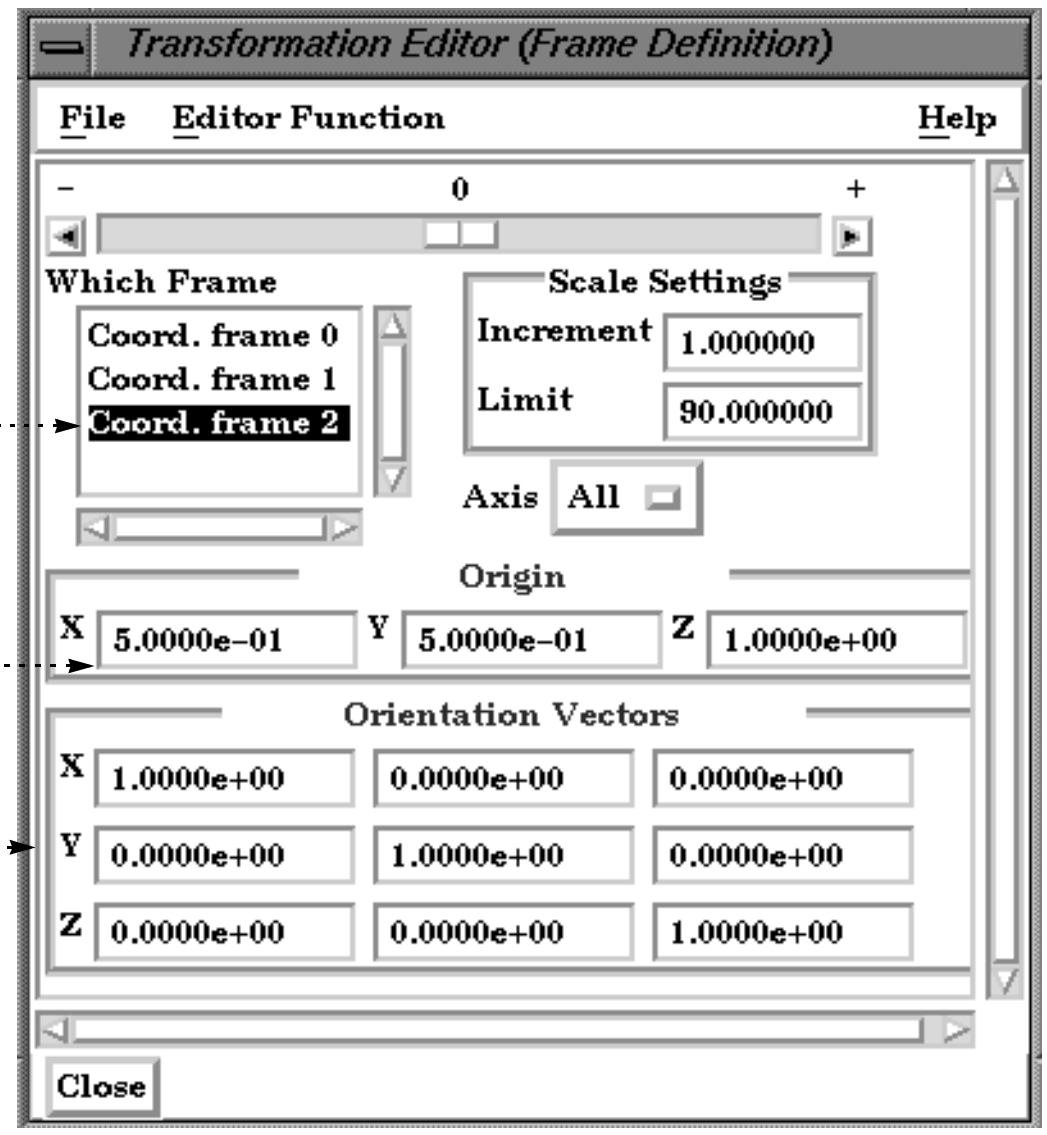
This opens the Transformation Editor dialog in Frame Definition mode.

3. **Select the desired frame(s).**

4. **If desired, enter new value(s) in the XYZ fields to change the frame's origin (remember to press return).**

5. **If desired, enter new value(s) for the orientation vectors (remember to press return).**

Note that the orientation vectors are renormalized when you press return.

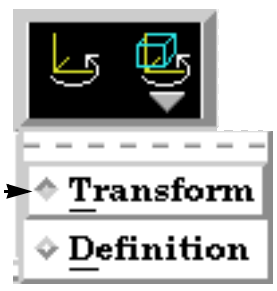


Reset Frame Transform

The frame transform can be reset back to the default position and orientation by using the Reset Tools and Viewports dialog. To clear the frame transform:

1. **Click Frame in the Mode Selection area to enter Frame mode.**

2. **Select Transform from the Transform/Definition pull-down.**



3. **Select the desired frame(s) (as described above).**

4. **Click the Reset... button in the Transformation Control area to open the Reset Tools and Viewports dialog.**

5. **In the Reset Tools and Viewports dialog, click the desired button:**

Reset By Selected Transform Only: clear only the transformation component currently selected (e.g. rotate or translate) in the Transformation Control area

Reset Rotate/Translate/Scale: clear all transformation components

See **How To Reset Tools and Viewports** for more information.

Set Frame Attributes

Frames can be displayed with a variety of attributes:

1. **Click Frame in the Mode Selection area to enter Frame mode. (If needed, first enable Frame Mode under Edit->Preferences..., General User Interface.)**

2. **Select the desired frame(s) (as described above).**

3. **Set the desired attribute as described below:**

Click the Frame Visibility Toggle to toggle display of the axis triad of selected frames on or off (when not in Frame Mode).

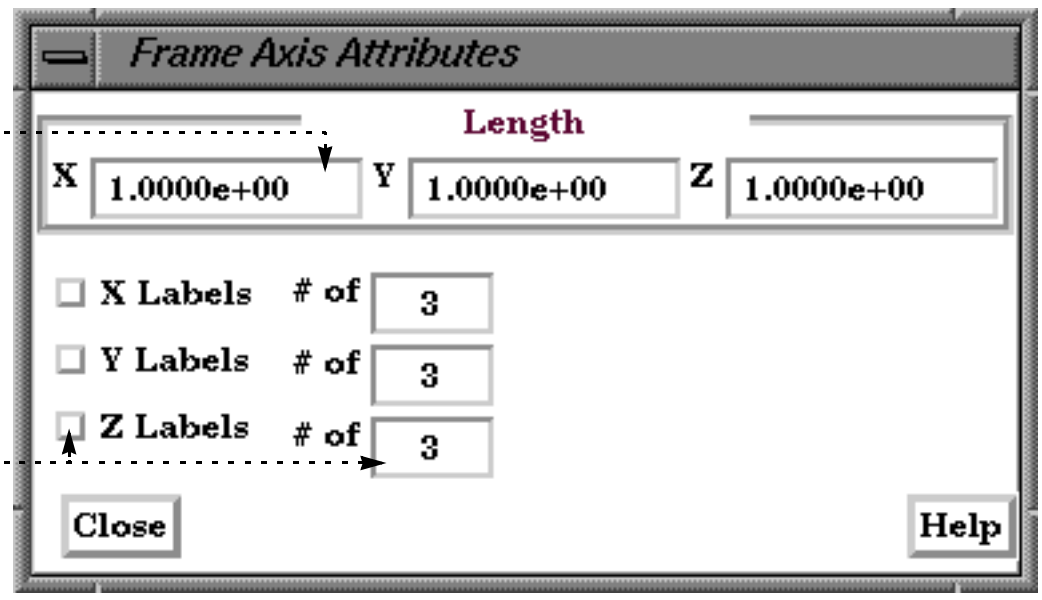
Click (opens the Color Selector) to set the color for the axis triad of selected frames.

Click the Frame Line Width pull-down to set the line width for the axis triad of selected frames.

Click the Axis Triad Attributes icon to set axis attributes (described below).

To adjust the length of the frame axes, enter new values in the X, Y, and Z Length fields and press return.

To display a series of evenly spaced labels along an axis (showing distance from the axis origin), toggle on the applicable Label button, enter the desired number of labels in the # of field, and press return.



Determine What Frame a Part is Assigned To

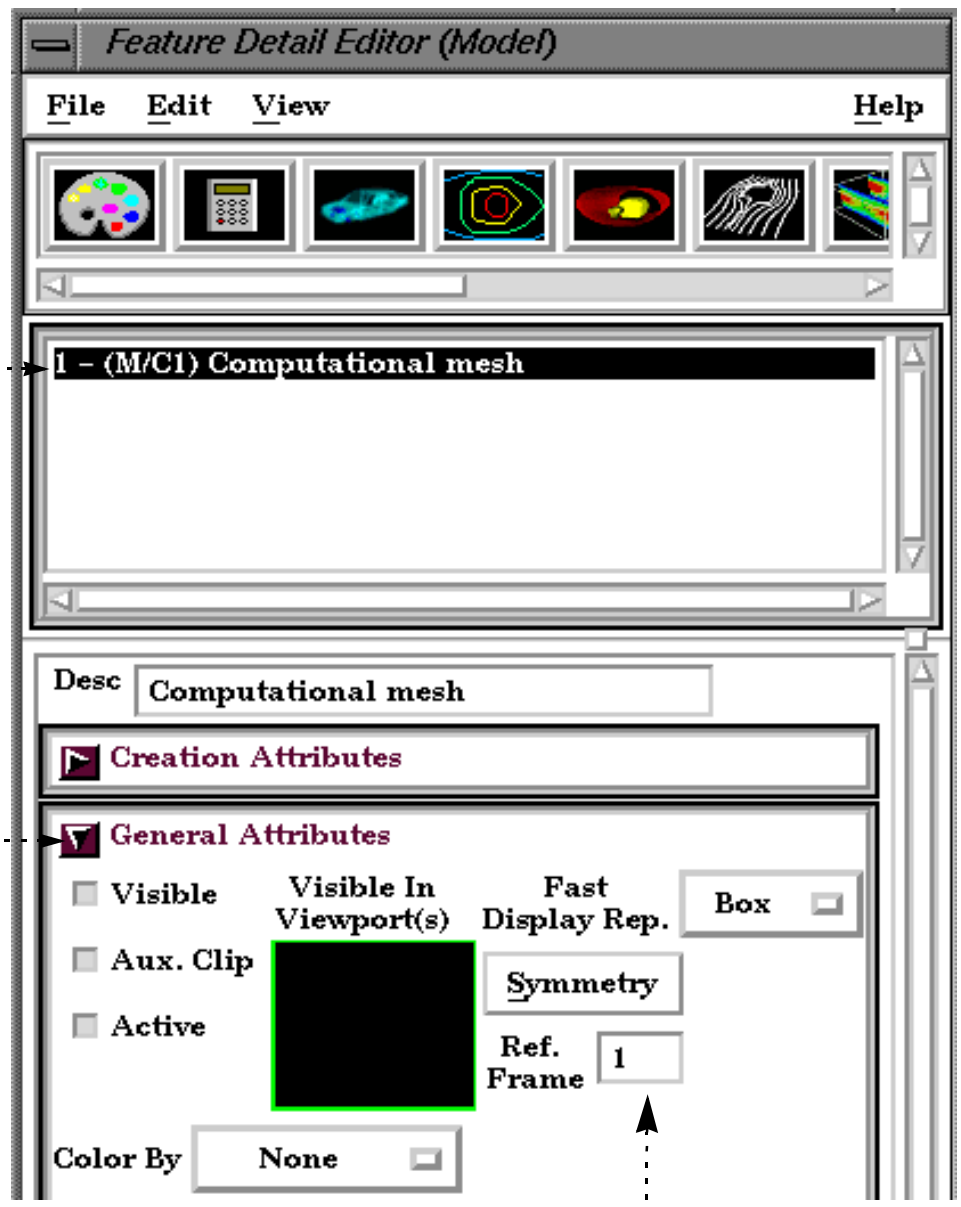
You can determine what frame a part is assigned to (and change it) by opening the Feature Detail Editor for the part:

1. **Open the Feature Detail Editor for the part type (Edit > Part Feature Detail Editors >) or double click on the appropriate Feature Icon.**

2. **Select the desired part in the parts list at the top of the Feature Detail Editor.**

3. **Open the General Attributes section.**

The part's current frame number is shown in the Ref. Frame field. You can reassign a part to a different frame by entering a new value and pressing return.



Delete Frames

Selected frames can be deleted. Note that a frame cannot be deleted if any parts are currently assigned to it. All parts assigned to the frame must be assigned to other frames prior to deletion.

1. **Click Frame in the Mode Selection area to enter Frame mode.**

2. **Select the desired frame(s) (as described above).**

3. **Click the Delete icon.**

See Also

How To Set Symmetry, **How To Rotate, Zoom, Translate, and Scale**, **How To Reset Tools and Viewports**

User Manual: **Frame Mode**