

# Chapter 5

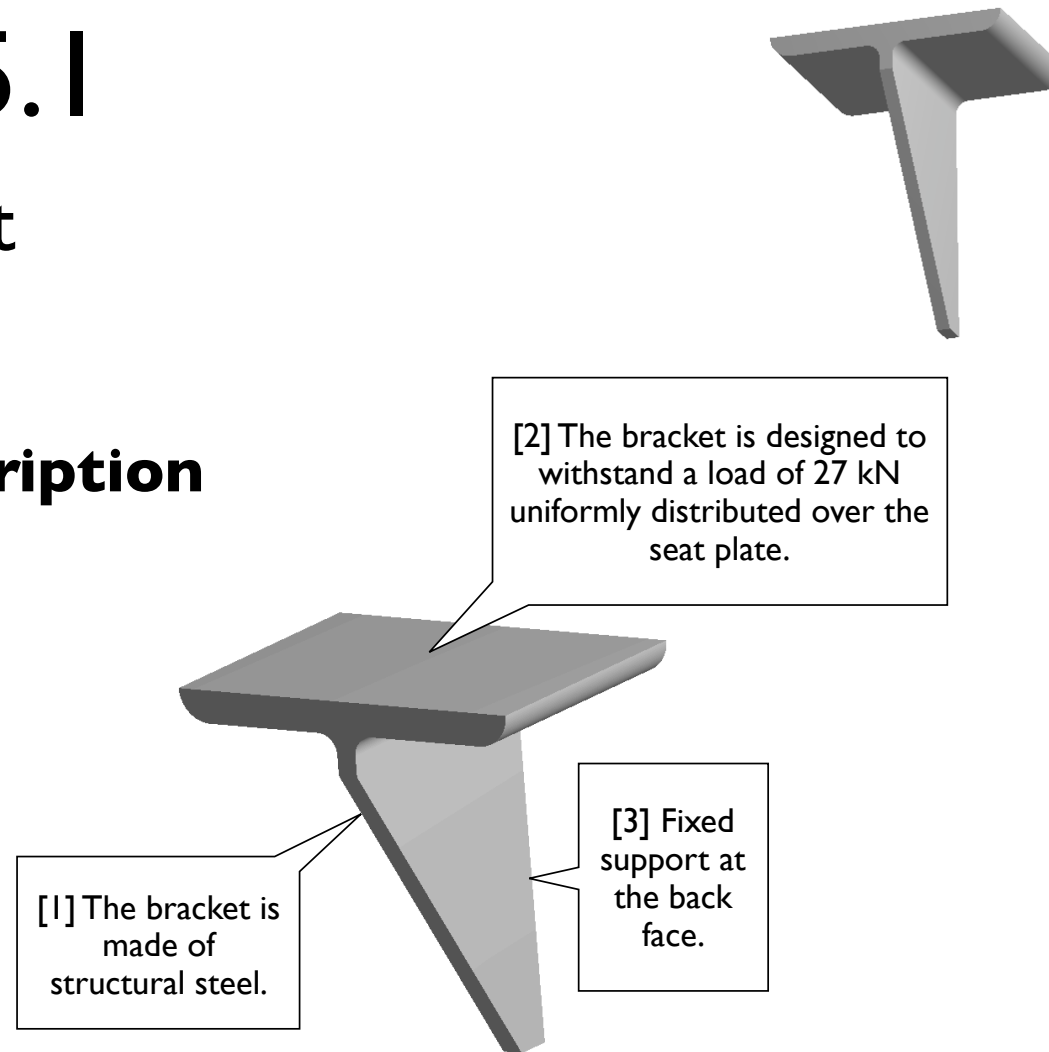
## 3D Simulations

- 5.1 Beam Bracket
- 5.2 Cover of Pressure Cylinder
- 5.3 More Details
- 5.4 LCD Display Support
- 5.5 Review

# Section 5.1

## Beam Bracket

### Problem Description



## Techniques/Concepts

- Engineering Data
- Material Assignment
- Stress Tool>Safety Factor
- Structural Error
- Mesh Control>MultiZone
- 3D Solid Elements

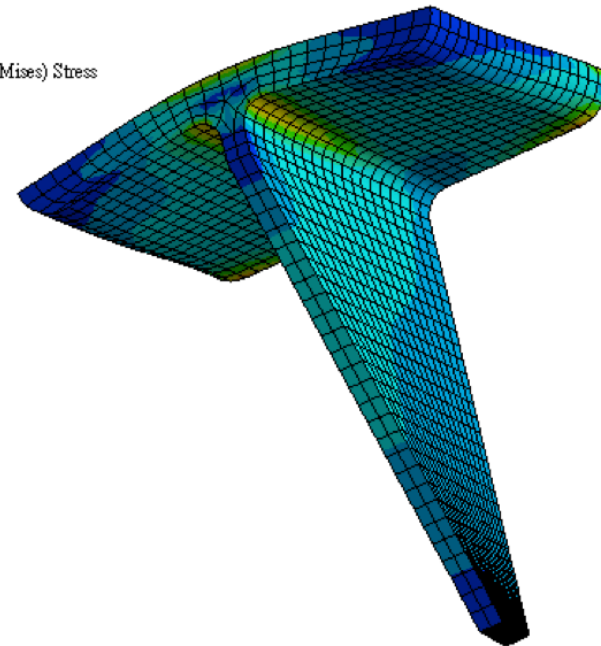
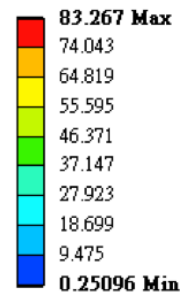
### A: Static Structural

Equivalent Stress

Type: Equivalent (von-Mises) Stress

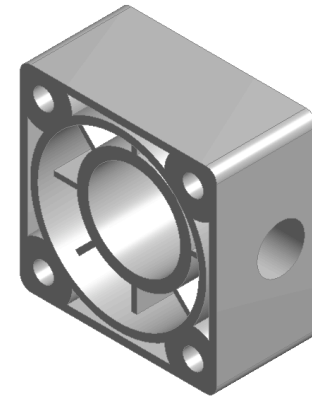
Unit: MPa

Time: 1

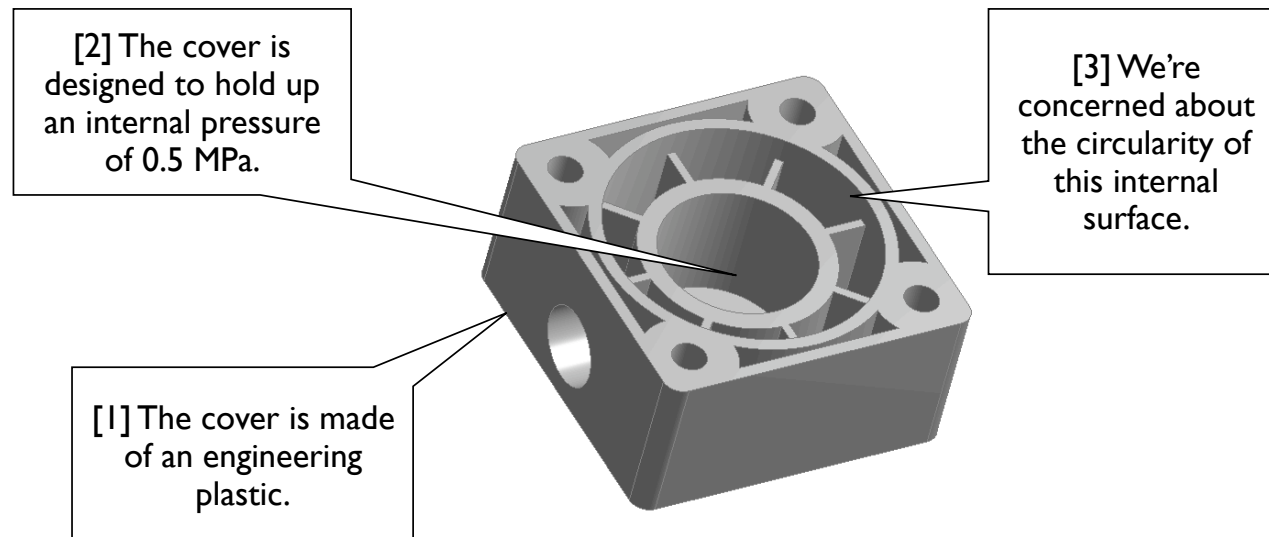


# Section 5.2

## Cover of Pressure Cylinder



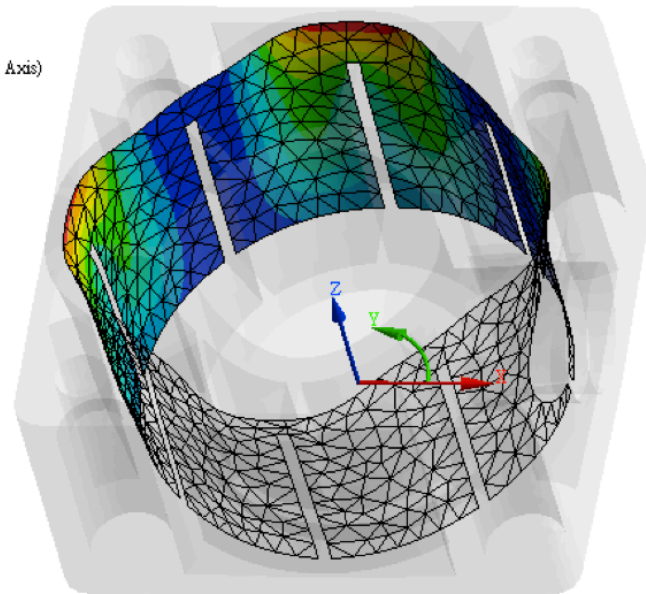
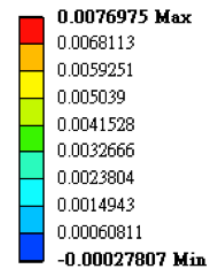
### Problem Description



## Techniques/Concepts

- Add a new material in **Engineering Data**
- Isotropic Elasticity
- Material Assignment
- Loads>Pressure
- Create a new coordinate system
- Cylindrical Coordinate Systems

**A: Static Structural**  
Directional Deformation  
Type: Directional Deformation(X Axis)  
Unit: mm  
Cylindrical Coordinate System  
Time: 1



# Section 5.3

## More Details

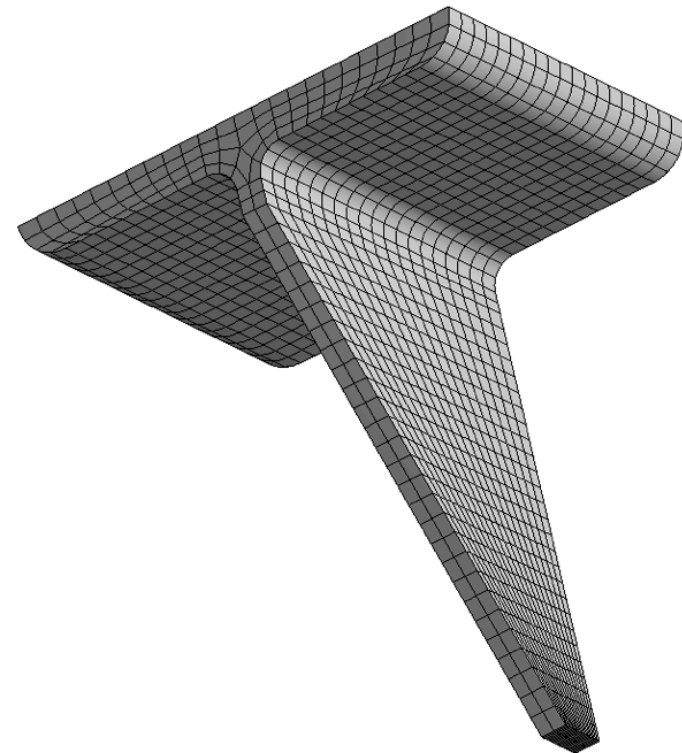
### Global Mesh Controls

- Relevance Center
- Relevance
- Number of nodes/elements
- Mesh Quality Metric

| Details of "Mesh"                              |                     |
|------------------------------------------------|---------------------|
| <input type="checkbox"/> <b>Display</b>        |                     |
| Display Style                                  | Body Color          |
| <input type="checkbox"/> <b>Defaults</b>       |                     |
| Physics Preference                             | Mechanical          |
| <input type="checkbox"/> Relevance             | 100                 |
| Shape Checking                                 | Standard Mechanical |
| Element Midside Nodes                          | Program Controlled  |
| <input type="checkbox"/> <b>Sizing</b>         |                     |
| Size Function                                  | Adaptive            |
| Relevance Center                               | Coarse              |
| <input type="checkbox"/> Element Size          | Default             |
| Initial Size Seed                              | Active Assembly     |
| Smoothing                                      | Medium              |
| Transition                                     | Fast                |
| Span Angle Center                              | Coarse              |
| Automatic Mesh Based Defeaturing               | On                  |
| <input type="checkbox"/> Defeaturing Tolerance | Default             |
| Minimum Edge Length                            | 1.53770 mm          |
| <input type="checkbox"/> <b>Inflation</b>      |                     |
| <input type="checkbox"/> <b>Advanced</b>       |                     |
| <input type="checkbox"/> <b>Statistics</b>     |                     |
| <input type="checkbox"/> Nodes                 | 27126               |
| <input type="checkbox"/> Elements              | 14820               |
| Mesh Metric                                    | None                |

## Mesh with MultiZone Method

- Generally, hexahedral elements are more desirable than tetrahedral.
- A simple idea of creating hexahedra is to mesh faces (source) of a body with quadrilaterals and then "sweep" along a path up to other end faces (target) of the body.
- Not all bodies are sweepable.
- The idea of **MultiZone** method is to decompose a non-sweepable body into several sweepable bodies, and then apply **Sweep** method on each of bodies.



## Coordinate Systems

- When defining an environment condition or a solution object by **Components**, you need a reference coordinate system. By default, **Global Coordinate System** is used, which is a Cartesian coordinate system.
- To define a new coordinate system, you need to define the type of the coordinate system, the origin, and the axes.

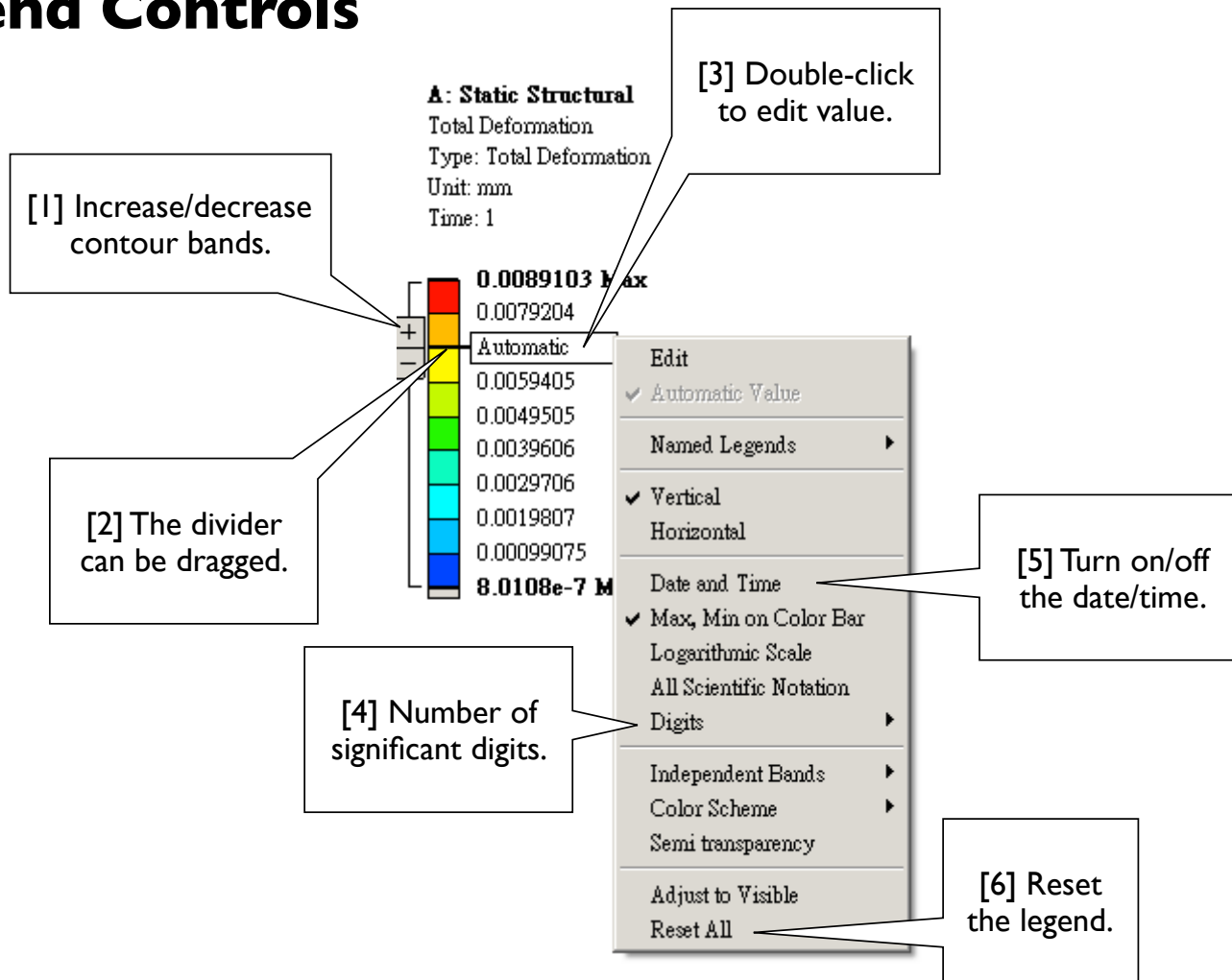
[1] Type of the coordinate system.

[2] Origin.

[3] Axes.

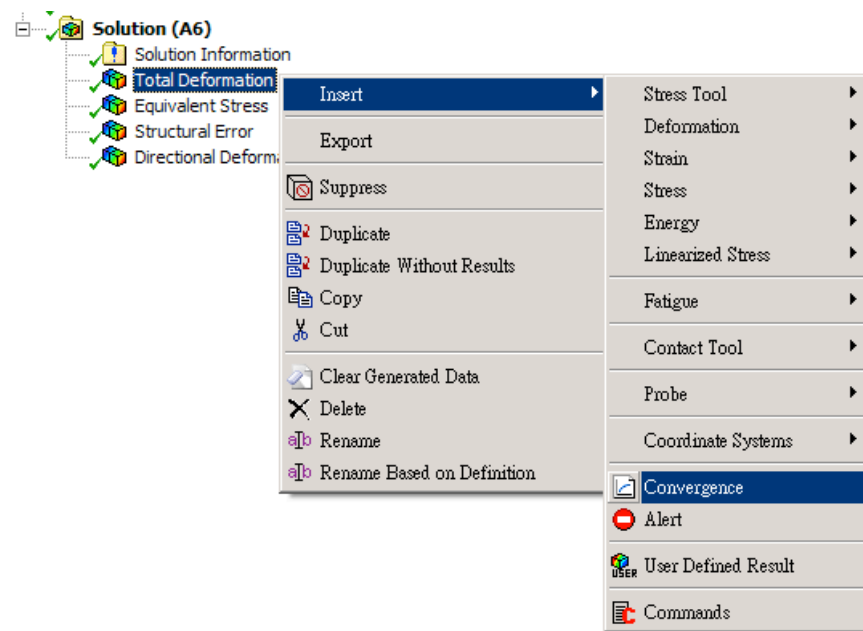
| Details of "Cylindrical Coordinate System" |                    |
|--------------------------------------------|--------------------|
| <b>Definition</b>                          |                    |
| Type                                       | Cylindrical        |
| Coordinate System                          | Program Controlled |
| <b>Origin</b>                              |                    |
| Define By                                  | Global Coordinates |
| Origin X                                   | 0. mm              |
| Origin Y                                   | 0. mm              |
| Origin Z                                   | 0. mm              |
| Location                                   | Click to Change    |
| <b>Principal Axis</b>                      |                    |
| Axis                                       | X                  |
| Define By                                  | Global X Axis      |
| <b>Orientation About Principal Axis</b>    |                    |
| Axis                                       | Y                  |
| Define By                                  | Default            |
| <b>Directional Vectors</b>                 |                    |
| X Axis Data                                | [ 1. 0. 0. ]       |
| Y Axis Data                                | [ 0. 1. 0. ]       |
| Z Axis Data                                | [ 0. 0. 1. ]       |
| <b>Transformations</b>                     |                    |
| Base Configuration                         | Absolute           |
| Transformed Configuration                  | [ 0. 0. 0. ]       |

## Legend Controls



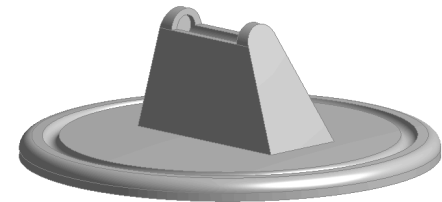
## Adaptive Meshing

- Workbench provides a tool to automate the mesh refinement until a user-specified level of accuracy is reached.
- This idea is termed **adaptive meshing**.
- Internally, Workbench uses the structural errors to help adjust the mesh, that is, it refines the mesh size in the area of large structural errors.

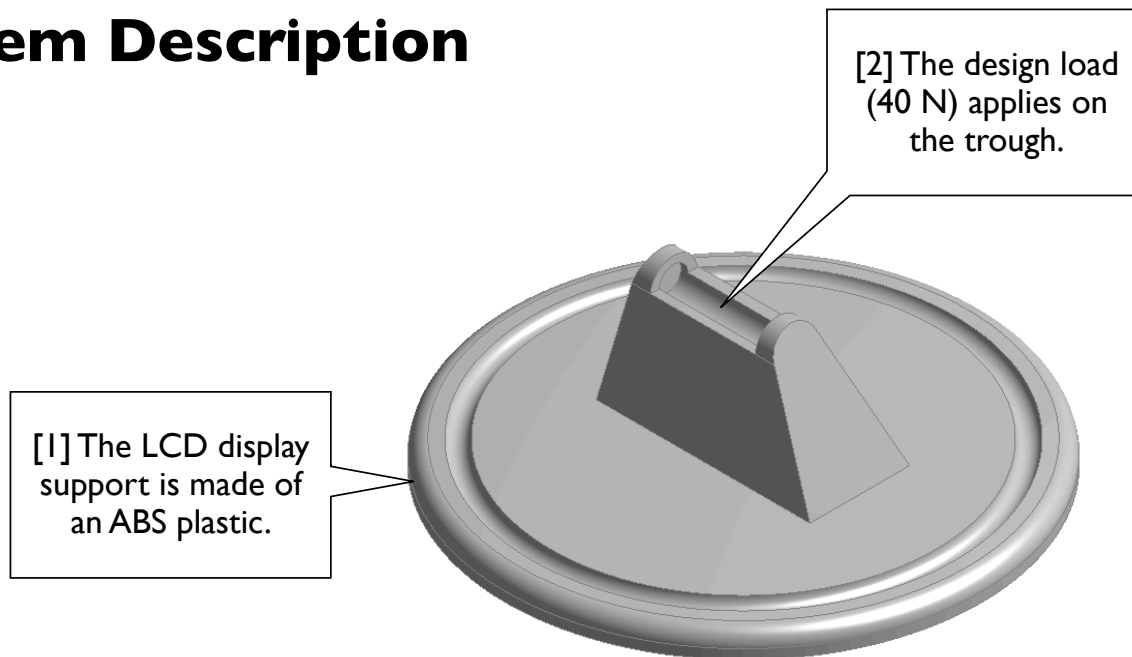


# Section 5.4

## LCD Display Support



### Problem Description



## Techniques/Concepts

- Loads>Bearing Load

**A: Static Structural**  
Maximum Principal Stress  
Type: Maximum Principal Stress  
Unit: MPa  
Time: 1

