# Applying Bearing Loads

| | **Material** | |
|---|---|---|
| Concrete | Concrete Floor | Magnesium Alloy (similar modulus to concrete) |
| Structural Steel | Wheel | Cast Carbon Steel |
| | **Connections** | |
| No Separation | Global Contact | No Penetration |
| | **Boundary Conditions** | |
| Frictionless Support | Symmetrical Faces | Roller/Slider |
| Fixed Support | Bottom of Floor | Fixed |
| | **Loading** | |
| Bearing Load (change *Vector* to *Components*: y = -2000 N) | 2000 N | Bearing Loads<br><br>1. Assembly > Reference Geometry<br>2. "Point" on each Arc Center<br>3. "Coordinate System" choose "Point" for *point* and hole's surface for z-*axis* (coordinate system's z-axis *must* be aligned with the hole's axis)<br><br>Load only in negative y-direction |
| | **Mesh** | |
| Medium | Main mesh | Default |
| Inner surface of hub and lower hole (*Refinement* = 1) | Refinements | Inner surface of hub and lower hole (*Apply mesh control*; move slider to 3/4 to Fine) |

# Optimization in SolidWorks

- Material: Create a custom material (6061 Aluminum Alloy)
  - See picture in zip file
  - For the Elastic modulus value, select *Link parameter* from the cell's dropdown menu
  - Click *Edit/define…*
  - Name: Elastic_modulus; Category: Simulation; Value: 6.9e10
  - Click OK; Select the new Parameter you created; Click *OK*
  - The cell should now be blue
- Fixtures: Roller/Slider…on symmetrical faces AND front face (so it doesn't float away!)
- External Loads: Bearing Loads
  - Need coordinate system @ center of each hole
  - Draw construction lines from center of hub to center of each hole; use this line for the coordinate system's x- or y-axis.
  - Create coordinate system using the construction line's point at the center of the hole, the construction line for the x- or y-axis, and the hole's surface for the z-axis (if necessary).
  - Apply bearing load of 300 N directed away from the hub center along the construction line.
- Mesh:  use default, but mesh control could be added for holes where stress concentrations will be higher.
- Run Simulation!!   Note "Yield Strength" on Von Mises Stress scale!

To create an optimization:
- Right-click on the tab (at the bottom of the window) for the Study you just created and Add Design Study
- Variable
  - Elastic modulus
    - Select *Elastic_modulus* from the list
    - Select *Discrete Values*: 1e10,5e10,1e11,5e11,1e12
    - Or define your own step size
  - Hole diameter
    - Select *Add parameter…*
    - Name: Hole_diameter
    - Category: Model Dimension
    - Select diameter dimension on part in main window.
    - Click *OK*
    - Either use the default range or define your own.
- Constraints
  - Select *Add sensor…*
  - Sensor Type > Simulation data
  - Data Quantity > Stress
  - Properties > Model Max
  - Click the green check mark
  - Select *Is less than* = 55 N/mm^2
- Goals
  - Select *Add sensor…*
  - Sensor Type > Mass
  - Click the green check mark
  - Select *Minimize*
- Run!