Tutorial
Design concept of a steering wheel

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In this tutorial the working steps regarding the conceptual design of a steering wheel are explained.

Note that material data, geometry and loads are quite arbitrarily chosen.
Start up **SolidThinking Inspire** and create the outer ring of the steering wheel.

Select the Circle by Center and Point sketching tool.

Click on the sketch plane once to place the center point of the circle, and define the length of the diameter. We will use 0.35m as this is the general steering wheel size.

To create additional circles, continue placing pairs of points. The thickness of the rim will be 0.03m.
Note: When you are done creating circles, press Esc or right-click. The cursor turns into a white arrow head, indicating that you can now click-and-drag the perimeter of the circle to change its diameter, or the centre point to change its location.

Press Esc or right-click to exit sketch mode. All closed loops are converted to sub-faces, the cursor changes to , and you are automatically placed in push/pull mode.

Move the cursor over the sub-face you just sketched.

Pull the sub-face outward by clicking-and-dragging the cursor normal to the face to extrude it into a solid.
Give the opposite dimension to the centre face so that it is removed

Press Esc or right-click to exit push-pull mode

Click on “z” in the coordinate system to get the front view of our model,

click on the top face of the part to activate a sketch plane
We need the sketch we are about to create to be a “new part”, hence click the Create New Part icon.

Create two concentric circles as before with the inner one being 0.1m diameter.

Push pull to get the below shape

Repeat the procedure for the third part; diameter is 0.06m
Now hide all parts except the largest centre part to modify it, we will remove the top half of the steering wheel so that the dashboard will be visible.

Select

**Arc by Center and Ends**

Click on the top face of the part for sketching plane, do not add a new part, click on the centre and two ends of the part and then close this arc with a straight line using the line option.

Right click to go to push/pull
enter the appropriate dimension to remove the top part,

Similarly we modify the outer part,
Create two arcs on either side with the above dimensions, join the arcs with straight lines

Push pull these sketches

Right click on this newly created part and duplicate it by copying it and pasting it in the same location

Now “Boolean” the outer ring to subtract the above part from the full ring
First select the outer ring and then the latest part

So now you have the below result

![Diagram of a wheel with selections made]

Colour the parts differently for easy use

![Diagram with parts coloured]

Now we will constrain the movement of the wheel, click on the supports section of the displacements option

Click on the innermost surface of the innermost part and this will create a rotational constraint as shown.

![Diagram with rotational constraint applied]
Double click on the constraint and do not select any degree of freedom so that it is completely constrained, it will turn red to indicate this,

Click on the torque option in the loads options,

Select the same surface, and enter 28 Nm as the torque (NHTSA paper - An Assessment of Human Driver Steering Capability. P18, Table 5.5. Overall Peak Torques Applied to the Steering Wheel)

Apply a pressure of 100 Pa on all sides of the handle part
Make the centre part the “design space”

Run the optimization with the following settings

In the result shown below the material was set to be “steel” (steel was used for the entire model)

The material can be changed easily by a right click on the relevant part in the model browser > select material > and choose the material necessary.
In this case the chosen material is ABS plastic material (plastic is used for the entire model)

Recommendations:

Change the thickness of the centre part, apply different loading conditions, add manufacturing constraints, symmetry constraints (shape controls in Inspire) and so on to investigate other design concepts.