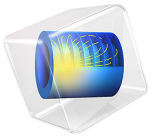

Atmospheric Corrosion of a Busbar — Template File

This model is a template MPH-file used by the Atmospheric Corrosion of a Busbar model. The geometry is a combination of a nut, a bolt and two flanges of a busbar and makes use of geometry subsequences specified in the Geometry Parts.

Application Library path: `Corrosion_Module/Atmospheric_Corrosion/atmospheric_corrosion_busbar_geom`

Modeling Instructions

From the **File** menu, choose **New**.

NEW

In the **New** window, click **Model Wizard**.

MODEL WIZARD

1 In the **Model Wizard** window, click **3D**.

2 Click **Done**.

GEOMETRY 1

First create geometry parts for bolt, nut, and flanges.

BOLT

1 In the **Geometry** toolbar, click **Create Part**.

2 In the **Settings** window for **Part**, type `Bolt` in the **Label** text field.

3 Locate the **Units** section. From the **Length unit** list, choose **mm**.

Work Plane 1 (wp1)

1 In the **Geometry** toolbar, click **Work Plane**.

2 In the **Settings** window for **Work Plane**, locate the **Plane Definition** section.

3 From the **Plane** list, choose **yz-plane**.

Work Plane 1 (wp1)>Plane Geometry

In the **Model Builder** window, click **Plane Geometry**.

Work Plane 1 (wp1)>Polygon 1 (pol1)

1 In the **Work Plane** toolbar, click **Polygon**.

2 In the **Settings** window for **Polygon**, locate the **Coordinates** section.

3 From the **Data source** list, choose **Vectors**.

4 In the **xw** text field, type `2 0 0 2.5 0 0 5.9 5.9 2.5 2.5 2`.

5 In the **yw** text field, type `0 0 16 16 16 20 16.7 16 16 0.5 0`.

Revolve 1 (rev1)

1 In the **Model Builder** window, right-click **Bolt** and choose **Revolve**.

2 In the **Settings** window for **Revolve**, locate the **Revolution Angles** section.

3 Clear the **Keep original faces** check box.

Work Plane 2 (wp2)

1 In the **Geometry** toolbar, click  **Work Plane**.

2 In the **Settings** window for **Work Plane**, locate the **Plane Definition** section.

3 In the **z-coordinate** text field, type `21.4`.

Work Plane 2 (wp2)>Plane Geometry

In the **Model Builder** window, click **Plane Geometry**.

Work Plane 2 (wp2)>Polygon 1 (pol1)

1 In the **Work Plane** toolbar, click  **Polygon**.

2 In the **Settings** window for **Polygon**, locate the **Coordinates** section.

3 From the **Data source** list, choose **Vectors**.

4 In the **xw** text field, type `0 0 0 -3.98372`.

5 In the **yw** text field, type `0 4.6 4.6 2.3`.

Work Plane 2 (wp2)>Rotate 1 (rot1)

1 In the **Work Plane** toolbar, click  **Transforms** and choose **Rotate**.

2 Select the object **pol1** only.

3 In the **Settings** window for **Rotate**, locate the **Rotation** section.

4 In the **Angle** text field, type `range(0,60,360)`.

Work Plane 2 (wp2)>Union 1 (uni1)

1 In the **Work Plane** toolbar, click  **Booleans and Partitions** and choose **Union**.

2 Click the  **Select All** button in the **Graphics** toolbar.

3 In the **Settings** window for **Union**, locate the **Union** section.

4 Clear the **Keep interior boundaries** check box.

Extrude 1 (ext1)

1 In the **Model Builder** window, under **Global Definitions>Geometry Parts>Bolt** right-click **Work Plane 2 (wp2)** and choose **Extrude**.

2 In the **Settings** window for **Extrude**, locate the **Distances** section.

3 In the table, enter the following settings:

Distances (mm)
5

4 Select the **Reverse direction** check box.

Union 1 (uni1)

1 In the **Geometry** toolbar, click  **Booleans and Partitions** and choose **Union**.

2 Click in the **Graphics** window and then press Ctrl+A to select both objects.

3 In the **Settings** window for **Union**, locate the **Union** section.

4 Clear the **Keep interior boundaries** check box.

NUT

1 In the **Geometry** toolbar, click  **Create Part**.

2 In the **Settings** window for **Part**, type `Nut` in the **Label** text field.

3 Locate the **Units** section. From the **Length unit** list, choose **mm**.

Work Plane 1 (wp1)

1 In the **Geometry** toolbar, click  **Work Plane**.

2 In the **Model Builder** window, collapse the **Nut** node.

3 In the **Model Builder** window, expand the **Nut** node, then click **Work Plane 1 (wp1)**.

4 In the **Settings** window for **Work Plane**, locate the **Plane Definition** section.

5 From the **Plane** list, choose **yz-plane**.

Work Plane 1 (wp1)>Plane Geometry

In the **Model Builder** window, click **Plane Geometry**.

Work Plane 1 (wp1)>Rectangle 1 (r1)

1 In the **Work Plane** toolbar, click  **Rectangle**.

2 In the **Settings** window for **Rectangle**, locate the **Size and Shape** section.

3 In the **Width** text field, type `2.253`.

4 In the **Height** text field, type `3.38`.

5 Locate the **Position** section. In the **xw** text field, type 2.

6 In the **yw** text field, type 8.

7 Click the  **Zoom Extents** button in the **Graphics** toolbar.

Work Plane 1 (wp1)>Chamfer 1 (cha1)

1 In the **Work Plane** toolbar, click  **Chamfer**.

2 Click the  **Zoom Extents** button in the **Graphics** toolbar.

3 On the object **r1**, select Points 1 and 4 only.

4 In the **Settings** window for **Chamfer**, locate the **Distance** section.

5 In the **Distance from vertex** text field, type 0.4.

Work Plane 1 (wp1)>Chamfer 2 (cha2)

1 In the **Work Plane** toolbar, click  **Chamfer**.

2 On the object **cha1**, select Point 5 only.

3 In the **Settings** window for **Chamfer**, locate the **Distance** section.

4 In the **Distance from vertex** text field, type 0.26.

Work Plane 1 (wp1)>Rectangle 2 (r2)

1 In the **Work Plane** toolbar, click  **Rectangle**.

2 In the **Settings** window for **Rectangle**, locate the **Size and Shape** section.

3 In the **Width** text field, type 1.15.

4 In the **Height** text field, type 0.7.

5 Locate the **Position** section. In the **xw** text field, type 3.103.

6 In the **yw** text field, type 10.68.

Work Plane 1 (wp1)>Rectangle 3 (r3)

1 In the **Work Plane** toolbar, click  **Rectangle**.

2 In the **Settings** window for **Rectangle**, locate the **Size and Shape** section.

3 In the **Width** text field, type 0.6.

4 In the **Height** text field, type 0.7.

5 Locate the **Position** section. In the **xw** text field, type 3.653.

6 In the **yw** text field, type 9.98.

Work Plane 1 (wp1)>Difference 1 (dif1)

1 In the **Work Plane** toolbar, click  **Booleans and Partitions** and choose **Difference**.

2 Select the object **cha2** only.

3 In the **Settings** window for **Difference**, locate the **Difference** section.

4 Click to select the **Activate Selection** toggle button for **Objects to subtract**.

5 Select the objects **r2** and **r3** only.

Revolve 1 (rev1)

In the **Model Builder** window, under **Global Definitions>Geometry Parts>Nut** right-click **Work Plane 1 (wp1)** and choose **Revolve**.

FLANGE 1

1 In the **Geometry** toolbar, click **Create Part**.

2 In the **Settings** window for **Part**, type `Flange 1` in the **Label** text field.

3 Locate the **Units** section. From the **Length unit** list, choose **mm**.

Block 1 (blk1)

1 In the **Geometry** toolbar, click **Block**.

2 In the **Settings** window for **Block**, locate the **Size and Shape** section.

3 In the **Width** text field, type `16`.

4 In the **Depth** text field, type `22.5`.

5 In the **Height** text field, type `3`.

6 Locate the **Position** section. In the **x** text field, type `-8`.

7 In the **y** text field, type `-9`.

8 In the **z** text field, type `13`.

Cylinder 1 (cyl1)

1 In the **Geometry** toolbar, click **Cylinder**.

2 In the **Settings** window for **Cylinder**, locate the **Size and Shape** section.

3 In the **Radius** text field, type `3.3`.

4 In the **Height** text field, type `3`.

5 Locate the **Position** section. In the **z** text field, type `13`.

Block 2 (blk2)

1 In the **Geometry** toolbar, click **Block**.

2 In the **Settings** window for **Block**, locate the **Size and Shape** section.

3 In the **Width** text field, type `16`.

4 In the **Depth** text field, type `3.75`.

5 In the **Height** text field, type `2.4`.

6 Locate the **Position** section. In the **x** text field, type `-8`.

7 In the **y** text field, type `13.5`.

8 In the **z** text field, type `13`.

Cylinder 2 (cyl2)

1 In the **Geometry** toolbar, click **Cylinder**.

2 In the **Settings** window for **Cylinder**, locate the **Size and Shape** section.

3 In the **Radius** text field, type `2`.

4 In the **Height** text field, type `3`.

5 Locate the **Position** section. In the **x** text field, type `8`.

6 In the **y** text field, type `17.25`.

7 In the **z** text field, type `13`.

Difference 1 (dif1)

1 In the **Geometry** toolbar, click **Booleans and Partitions** and choose **Difference**.

2 Select the object **blk1** only.

3 In the **Settings** window for **Difference**, locate the **Difference** section.

4 Click to select the **Activate Selection** toggle button for **Objects to subtract**.

5 Select the object **cyl1** only.

Difference 2 (dif2)

1 In the **Geometry** toolbar, click **Booleans and Partitions** and choose **Difference**.

2 Select the object **blk2** only.

3 In the **Settings** window for **Difference**, locate the **Difference** section.

4 Click to select the **Activate Selection** toggle button for **Objects to subtract**.

5 Select the object **cyl2** only.

Mirror 1 (mir1)

1 In the **Geometry** toolbar, click **Transforms** and choose **Mirror**.

2 Click in the **Graphics** window and then press Ctrl+A to select both objects.

3 In the **Settings** window for **Mirror**, locate the **Input** section.

4 Select the **Keep input objects** check box.

5 Locate the **Point on Plane of Reflection** section. In the **y** text field, type `17.25`.

6 Locate the **Normal Vector to Plane of Reflection** section. In the **y** text field, type `1`.

7 In the **z** text field, type `0`.

Union 1 (uni1)

1 In the **Geometry** toolbar, click  **Booleans and Partitions** and choose **Union**.

2 Select the objects **dif2** and **mir1(2)** only.

FLANGE 2

1 In the **Geometry** toolbar, click  **Create Part**.

2 In the **Settings** window for **Part**, type `Flange 2` in the **Label** text field.

3 Locate the **Units** section. From the **Length unit** list, choose **mm**.

Block 1 (blk1)

1 In the **Geometry** toolbar, click  **Block**.

2 In the **Settings** window for **Block**, locate the **Size and Shape** section.

3 In the **Width** text field, type `13`.

4 In the **Depth** text field, type `16`.

5 In the **Height** text field, type `1.5`.

6 Locate the **Position** section. In the **x** text field, type `-6.5`.

7 In the **y** text field, type `-8`.

8 In the **z** text field, type `11.5`.

Cylinder 1 (cyl1)

1 In the **Geometry** toolbar, click  **Cylinder**.

2 In the **Settings** window for **Cylinder**, locate the **Size and Shape** section.

3 In the **Radius** text field, type `3.3`.

4 In the **Height** text field, type `3`.

5 Locate the **Position** section. In the **z** text field, type `11.5`.

Difference 1 (dif1)

1 In the **Geometry** toolbar, click  **Booleans and Partitions** and choose **Difference**.

2 Select the object **blk1** only.

3 In the **Settings** window for **Difference**, locate the **Difference** section.

4 Click to select the  **Activate Selection** toggle button for **Objects to subtract**.

5 Select the object **cyl1** only.

Work Plane 1 (wp1)

1 In the **Geometry** toolbar, click  **Work Plane**.

2 In the **Settings** window for **Work Plane**, locate the **Plane Definition** section.

3 From the **Plane type** list, choose **Face parallel**.

4 On the object **dif1**, select Boundary 2 only.

Work Plane 1 (wp1)>Plane Geometry

1 In the **Model Builder** window, click **Plane Geometry**.

2 In the **Work Plane** toolbar, click **Sketch** to toggle off sketch mode.

Work Plane 1 (wp1)>Rectangle 1 (r1)

1 In the **Work Plane** toolbar, click **Rectangle**.

2 In the **Settings** window for **Rectangle**, locate the **Size and Shape** section.

3 In the **Width** text field, type `1.7`.

4 In the **Height** text field, type `1.5`.

5 Locate the **Position** section. In the **xw** text field, type `-4.45`.

6 In the **yw** text field, type `-10`.

Work Plane 1 (wp1)>Circle 1 (c1)

1 In the **Work Plane** toolbar, click **Circle**.

2 In the **Settings** window for **Circle**, locate the **Object Type** section.

3 From the **Type** list, choose **Curve**.

4 Locate the **Size and Shape** section. In the **Radius** text field, type `3.5`.

5 In the **Sector angle** text field, type `90`.

6 Locate the **Position** section. In the **xw** text field, type `-2.75`.

7 In the **yw** text field, type `-6.5`.

8 Locate the **Rotation Angle** section. In the **Rotation** text field, type `-90`.

9 Click to expand the **Layers** section. In the table, enter the following settings:

Layer name	Thickness (mm)
`Layer 1`	`1.5`

Work Plane 1 (wp1)>Circle 2 (c2)

1 In the **Work Plane** toolbar, click **Circle**.

2 In the **Settings** window for **Circle**, locate the **Object Type** section.

3 From the **Type** list, choose **Curve**.

4 Locate the **Size and Shape** section. In the **Radius** text field, type `3.5`.

5 In the **Sector angle** text field, type `90`.

6 Locate the **Position** section. In the **xw** text field, type `-4.45`.

7 In the **yw** text field, type `-12`.

8 Locate the **Rotation Angle** section. In the **Rotation** text field, type `90`.

9 Locate the **Layers** section. In the table, enter the following settings:

Layer name	Thickness (mm)
`Layer 1`	`1.5`

Work Plane 1 (wp1)>Delete Entities 1 (del1)

1 In the **Work Plane** toolbar, click **Delete**.

2 In the **Settings** window for **Delete Entities**, locate the **Entities or Objects to Delete** section.

3 From the **Geometric entity level** list, choose **Boundary**.

4 Click the **Zoom Extents** button in the **Graphics** toolbar.

5 On the object **c1**, select Boundaries 1 and 2 only.

6 On the object **c2**, select Boundaries 1 and 2 only.

Extrude 1 (ext1)

1 In the **Model Builder** window, under **Global Definitions>Geometry Parts>Flange 2** right-click **Work Plane 1 (wp1)** and choose **Extrude**.

2 In the **Settings** window for **Extrude**, locate the **Distances** section.

3 In the table, enter the following settings:

Distances (mm)
16

4 Select the **Reverse direction** check box.

Block 2 (blk2)

1 In the **Geometry** toolbar, click **Block**.

2 In the **Settings** window for **Block**, locate the **Size and Shape** section.

3 In the **Width** text field, type `23`.

4 In the **Depth** text field, type `52`.

5 In the **Height** text field, type `1.5`.

6 Locate the **Position** section. In the **x** text field, type `12`.

7 In the **y** text field, type `-8`.

8 In the **z** text field, type `4.3`.

Union 1 (uni1)

1 In the **Geometry** toolbar, click **Booleans and Partitions** and choose **Union**.

2 Click in the **Graphics** window and then press Ctrl+A to select all objects.

FLANGE 2

In the **Model Builder** window, collapse the **Global Definitions>Geometry Parts>Flange 2** node.

GEOMETRY 1

Now create geometry by forming union of all geometry parts.

Bolt 1 (pi1)

In the **Geometry** toolbar, click **Part Instance** and choose **Bolt**.

Nut 1 (pi2)

In the **Geometry** toolbar, click **Part Instance** and choose **Nut**.

Flange 1 1 (pi3)

In the **Geometry** toolbar, click **Part Instance** and choose **Flange 1**.

Flange 2 1 (pi4)

1 In the **Geometry** toolbar, click **Part Instance** and choose **Flange 2**.

2 In the **Settings** window for **Part Instance**, click **Build All Objects**.

3 Click the **Zoom Extents** button in the **Graphics** toolbar.

DEFINITIONS

Finally, create selections for different geometry entities which will be used later while setting up the model and during postprocessing.

Cu Domain

1 In the **Definitions** toolbar, click **Explicit**.

2 In the **Settings** window for **Explicit**, type `Cu Domain` in the **Label** text field.

3 Locate the **Input Entities** section. Click **Paste Selection**.

4 In the **Paste Selection** dialog box, type `1-3` in the **Selection** text field.

5 Click **OK**.

6 Select Domains 1–4 only.

Al Domain

1 In the **Definitions** toolbar, click **Explicit**.

2 In the **Settings** window for **Explicit**, type `Al Domain` in the **Label** text field.

3 Select Domains 5 and 9–12 only.

Bolt (Zn)

1 In the **Definitions** toolbar, click **Explicit**.

2 In the **Settings** window for **Explicit**, type `Bolt (Zn)` in the **Label** text field.

3 Select Domains 6–8 only.

Cu Surface

1 In the **Definitions** toolbar, click **Adjacent**.

2 In the **Settings** window for **Adjacent**, type `Cu Surface` in the **Label** text field.

3 Locate the **Input Entities** section. Under **Input selections**, click **Add**.

4 In the **Add** dialog box, select **Cu Domain** in the **Input selections** list.

5 Click **OK**.

Al Surface

1 In the **Definitions** toolbar, click **Adjacent**.

2 In the **Settings** window for **Adjacent**, type `Al Surface` in the **Label** text field.

3 Locate the **Input Entities** section. Under **Input selections**, click **Add**.

4 In the **Add** dialog box, select **Al Domain** in the **Input selections** list.

5 Click **OK**.

Zn Surface

1 In the **Definitions** toolbar, click **Adjacent**.

2 In the **Settings** window for **Adjacent**, type `Zn Surface` in the **Label** text field.

3 Locate the **Input Entities** section. Under **Input selections**, click **Add**.

4 In the **Add** dialog box, select **Bolt (Zn)** in the **Input selections** list.

5 Click **OK**.

All Domains

1 In the **Definitions** toolbar, click **Explicit**.

2 Select Domains 1–7 and 9–12 only.

3 In the **Settings** window for **Explicit**, type `All Domains` in the **Label** text field.

Exterior Boundaries

1 In the **Definitions** toolbar, click **Adjacent**.

2 In the **Settings** window for **Adjacent**, type `Exterior Boundaries` in the **Label** text field.

3 Locate the **Input Entities** section. Under **Input selections**, click **Add**.

4 In the **Add** dialog box, select **All Domains** in the **Input selections** list.

5 Click **OK**.

Cu Terminal Boundary

1 In the **Definitions** toolbar, click **Explicit**.

2 In the **Settings** window for **Explicit**, type `Cu Terminal Boundary` in the **Label** text field.

3 Locate the **Input Entities** section. From the **Geometric entity level** list, choose **Boundary**.

4 Select Boundary 16 only.

Al Terminal Boundary

1 In the **Definitions** toolbar, click **Explicit**.

2 In the **Settings** window for **Explicit**, type `Al Terminal Boundary` in the **Label** text field.

3 Locate the **Input Entities** section. From the **Geometric entity level** list, choose **Boundary**.

4 Select Boundary 157 only.

Inner Boundaries

1 In the **Definitions** toolbar, click **Cylinder**.

2 In the **Settings** window for **Cylinder**, type `Inner Boundaries` in the **Label** text field.

3 Locate the **Geometric Entity Level** section. From the **Level** list, choose **Boundary**.

4 Locate the **Size and Shape** section. In the **Outer radius** text field, type `0.0026`.

5 In the **Top distance** text field, type `0.011`.

6 In the **Bottom distance** text field, type `0`.

7 Locate the **Position** section. In the **z** text field, type `0.0075`.

8 Locate the **Output Entities** section. From the **Include entity if** list, choose **Entity inside cylinder**.

Exterior Surfaces

1 In the **Definitions** toolbar, click **Difference**.

2 In the **Settings** window for **Difference**, type `Exterior Surfaces` in the **Label** text field.

3 Locate the **Geometric Entity Level** section. From the **Level** list, choose **Boundary**.

4 Locate the **Input Entities** section. Under **Selections to add**, click **Add**.

5 In the **Add** dialog box, select **Exterior Boundaries** in the **Selections to add** list.

6 Click **OK**.

7 In the **Settings** window for **Difference**, locate the **Input Entities** section.

8 Under **Selections to subtract**, click + **Add**.

9 In the **Add** dialog box, in the **Selections to subtract** list, choose **Cu Terminal Boundary**, **Al Terminal Boundary**, and **Inner Boundaries**.

10 Click **OK**.

Exterior Cu Surface

1 In the **Definitions** toolbar, click  **Intersection**.

2 In the **Settings** window for **Intersection**, type `Exterior Cu Surface` in the **Label** text field.

3 Locate the **Geometric Entity Level** section. From the **Level** list, choose **Boundary**.

4 Locate the **Input Entities** section. Under **Selections to intersect**, click + **Add**.

5 In the **Add** dialog box, in the **Selections to intersect** list, choose **Cu Surface** and **Exterior Surfaces**.

6 Click **OK**.

Exterior Al Surface

1 In the **Definitions** toolbar, click  **Intersection**.

2 In the **Settings** window for **Intersection**, type `Exterior Al Surface` in the **Label** text field.

3 Locate the **Geometric Entity Level** section. From the **Level** list, choose **Boundary**.

4 Locate the **Input Entities** section. Under **Selections to intersect**, click + **Add**.

5 In the **Add** dialog box, in the **Selections to intersect** list, choose **Al Surface** and **Exterior Surfaces**.

6 Click **OK**.

Exterior Zn Surface

1 In the **Definitions** toolbar, click  **Intersection**.

2 In the **Settings** window for **Intersection**, type `Exterior Zn Surface` in the **Label** text field.

3 Locate the **Geometric Entity Level** section. From the **Level** list, choose **Boundary**.

4 Locate the **Input Entities** section. Under **Selections to intersect**, click + **Add**.

5 In the **Add** dialog box, in the **Selections to intersect** list, choose **Zn Surface** and **Exterior Surfaces**.

6 Click **OK**.