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Dorian Nedelcu

Computer Aided Design of an Admission Valve with Autodesk Inventor

The paper presents the steps for 3D computer aided design (CAD) of an admission valve made by Autodesk Inventor.

Introduction

The admission valve has a complex 3D geometry, figure 1 [1], which must be generate in a CAD software software for the final drawing and for finite elements resistance calculus. As a CAD software was chosen Autodesk Inventor [2], [3], [4]. There are described step by step the procedure of admission valve CAD modelling.

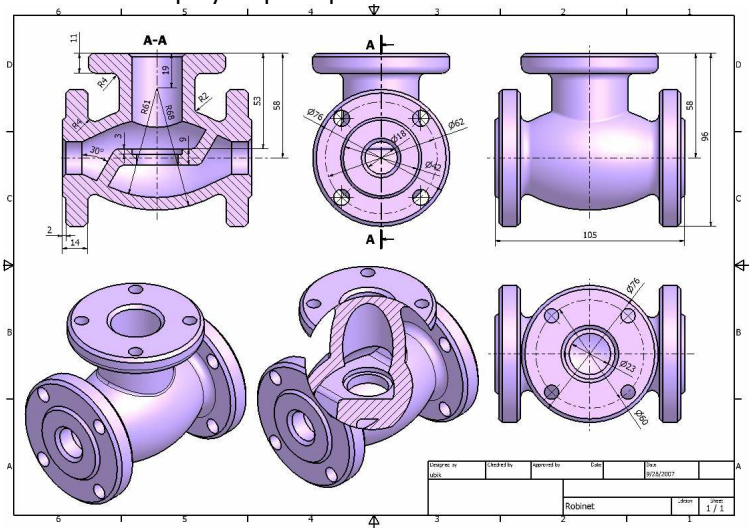

Figure 1. The main dimensions of the admission valve

The base contour revolution

The first step is to draw the sketch of the base contour, figure 2. The complete sketch is obtained by mirror of the left contour around the vertical symmetry axe. The **Revolve** command will generate the 3D geometry of the body, by revolving the complete contour around the horizontal symmetry axe, figure 3.

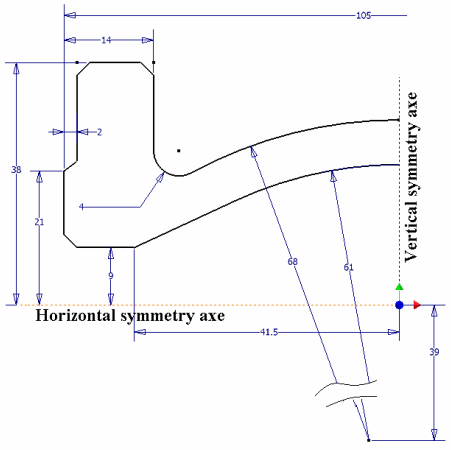

Figure 2. The base contour sketch

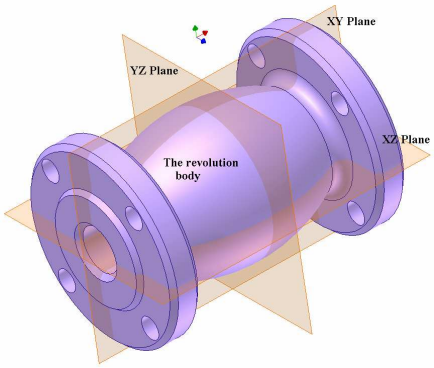

Figure 3. The revolution body

The top cylinder and top flange

The construction of the admission valve top cylinder is showed in figure 4. With command **Work Plane** will be generate a working plane at 58 mm distance away from XY Plane. In the working plane is drawn a circle with 42 mm diameter. The command **Extrude** and **Join** option will generate the 3D geometry of the top cylinder, by circle extrusion to the next face of the body.

The construction of the admission valve top flange is showed in figure 5. In the working plane is drawn a circle with 76 mm diameter. The command **Extrude** will generate the 3D geometry of the top flange, by circle extrusion on 11 mm distance.

The chamfer and fillet's of the top flange and cylinder

With command **Chamfer** will be construct the chamfer 2 x 45^{o} for top flange, figure 6. With command **Fillet** will be construct the fillet's R4 for top flange. With command **Fillet** will be construct the rounding surface R2 between the revolution body and top cylinder.

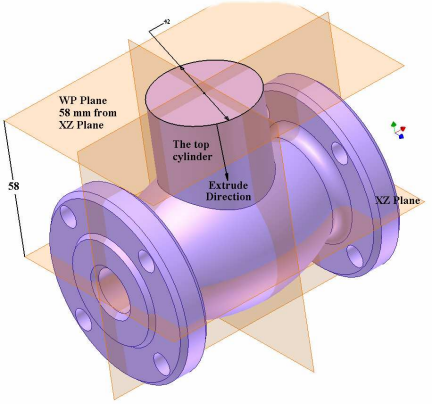

Figure 4. The top cylinder

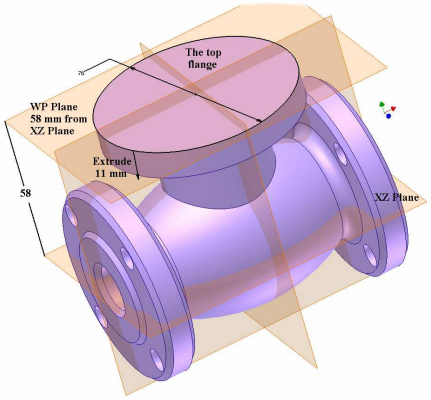

Figure 5. The top flange

The holes Φ8 and Φ28 in the top flange and cylinder

In the top flange plane will be sketched the circle with 60 mm diameter. In four points will be placed four marker for the future hole's, with command **Point, Hole Center**. The holes with 8 mm diameter will be generating with command **Hole**, with 11 mm depth, figure 7.

In the top flange plane will be sketched the circle with 28 mm diameter. The central hole with 28 mm diameter will be generating with **Extrude** command and **Cut** option on 50 mm depth, figure 7.

With command **Chamfer** will be construct the chamfer 2 x 45^{o} for top flange, on cylinder with Φ28 mm diameter, figure 8.

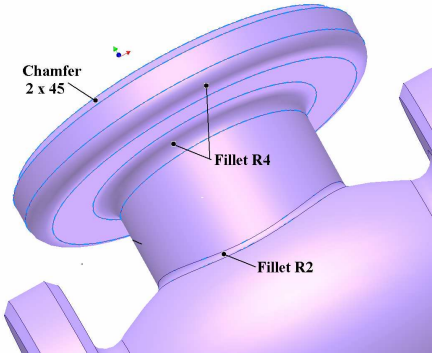

Figure 6. The chamfer and fillet's of the top flange and cylinder

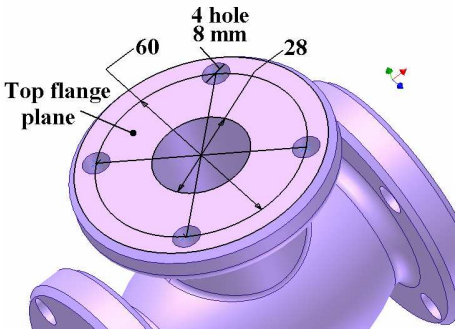

Figure 7. The holes Φ8 and Φ28 in the top flange and cylinder

The median wall

In the WY plane will be sketched the median wall contour, figure 8. The left-median wall will be generating with **Extrude** command and **Join** option extrusion to the next face of the inner body, figure 9. The median wall contour must be declared as **Share Sketch** to be used again to generate the symmetrical 3D geometry of the median wall. The right median wall will be generating with **Extrude** command and **Join** option extrusion to the next face of the inner body in the opposite direction comparing to the previous command.

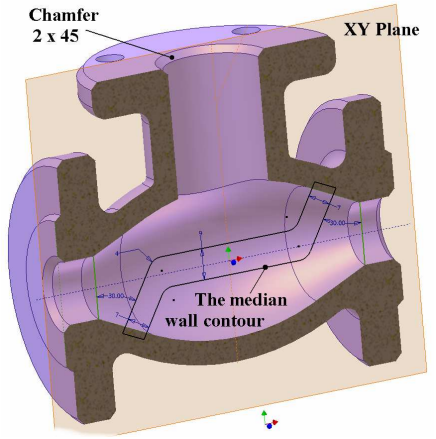

Figure 8. The median wall contour

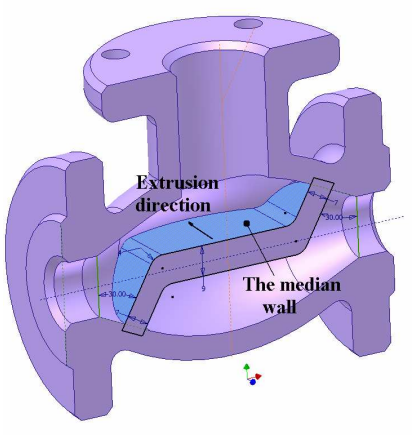

Figure 9. The median wall

The Φ28 and Φ23 cuts in median wall

In the top plane of the median wall will be sketched the circle with Φ28 mm diameter, figure 10. The Φ28 cut will be generating with **Extrude** command and **Cut** option on 3 mm depth, figure 10. The same steps will be followed for Φ23 cut.

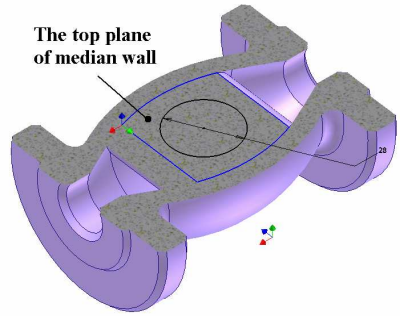

Figure 10. The Φ28 / Φ23 circles

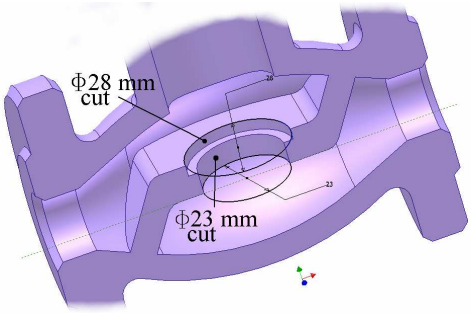

Figure 11. The Φ28 and Φ23 cuts

The holes Φ9 in the lateral flange

In the lateral flange plane will be sketched the circle with 62 mm diameter. In four points will be placed four marker for the future hole's, with command **Point, Hole Center**, figure 12. The four holes with 9 mm diameter will be generating with command **Hole**, with 14 mm depth, figure 13. The symmetrical four holes with 9 mm diameter in the opposite lateral flange will be generating by **Mirror Feature** command.

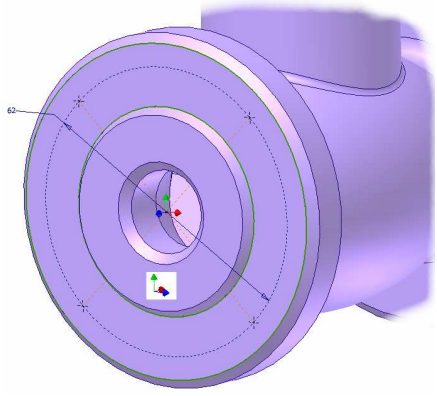

Figure 12. The Φ28 / Φ23 circles

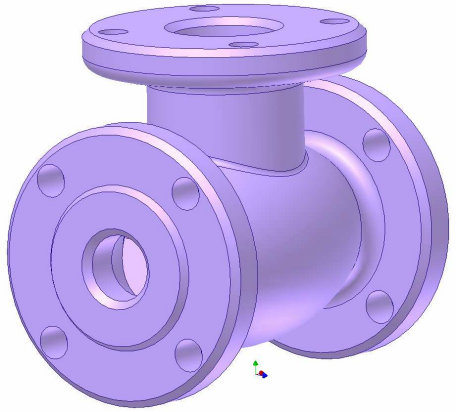

Figure 13. The Φ28 and Φ23 cuts

The final admission valve 3D geometry

The final 3D geometry of the admission valve is presented in figure 15. The steps followed to obtain the geometry (**The Browser Bar**) are presented in figure 14. The Browser Bar is a history of the modelling process.

Conclusions

Autodesk Inventor is a powerful CAD software for 3D geometry modelling, which can be used for: Parts Sketch, Parts Features design, creating Adaptive Parts, creating Derived Parts, creating iFeatures, Assemblies, Drawing Geometry and Drawing Annotation, Weldments, Motion Presentation of the Assemblies, Sheet metal, Stress Analysis, Cable and Harness, Tube and Pipe.

The present paper is a tutorial for an admission valve 3D geometry, which is dedicated to the Parts Sketch and Parts Features design, figure 13, and Drawing Geometry and Drawing Annotation, figure 1.

The admission valve will be analysed with finite element method, with Cosmos Design Star software, to obtain stress distribution[4].

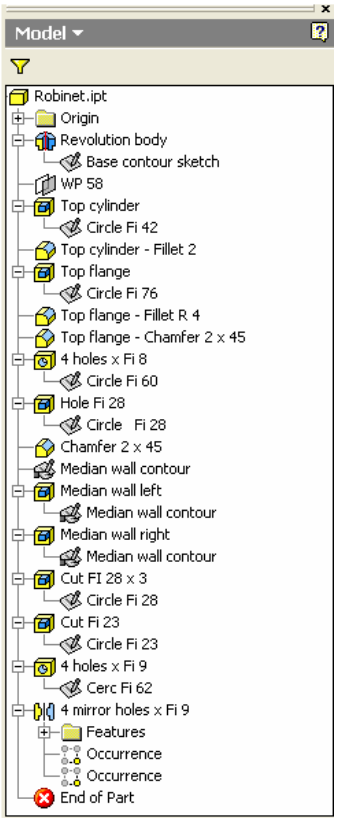

Figure 14. The Browser Bar

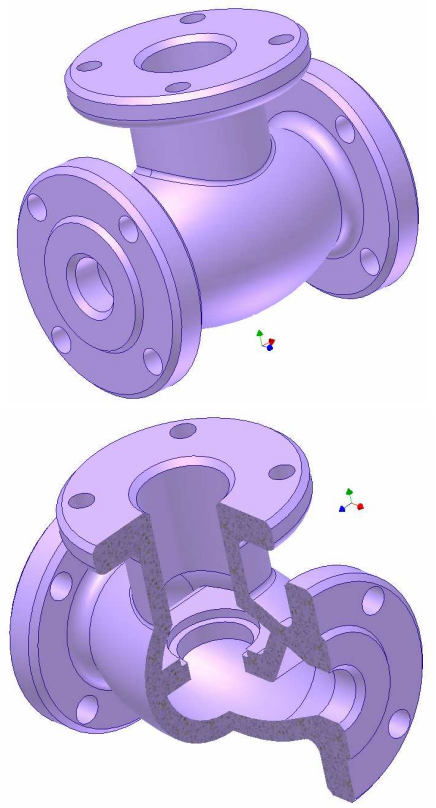

Figure 15. The admission valve 3D model

References

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Assoc. Prof. Dr. Eng. Dorian Nedelcu, "Eftimie Murgu" University of Reşiţa,
Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, d.nedelcu@uem.ro