

DESIGN OF CENTRAL FUSELAGE IN CATIA V5

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ABSTRACT

The objective of the project was to design the fuselage section of an aircraft in Catia V5. The fuselage was designed in Catia using various methods, techniques and modules.

KEYWORDS

Fuselage, 3D modeling in Catia V5, Stringers, Longerons, Frames, Bulkhead and Shear Clip

1. INTRODUCTION

Fuselage of a modern aircraft is a stiffened shell commonly referred to as semi-monocoque construction. In order to support the skin, it is necessary to provide stiffening members like frames, bulkheads, stringers and longerons. Fuselage as a beam member contains longitudinal elements (longerons and stringers) and transverse elements (frames and bulkheads) and its external skin.

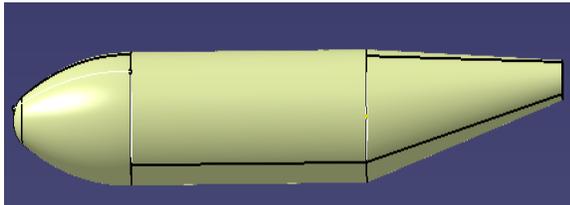


Fig. 1. Fuselage

1.1 Basic Definition Of Fuselage Parts

1.1.1 Stringers

In addition to stabilizing the external skin, it also carry axial loads by bending moment. Longitudinal stringers provide efficient resistance to compressive stresses. They carry the major portion of the fuselage bending moment, loaded by axial forces resulting from the bending moment. They are thicker in width but extends same in length.

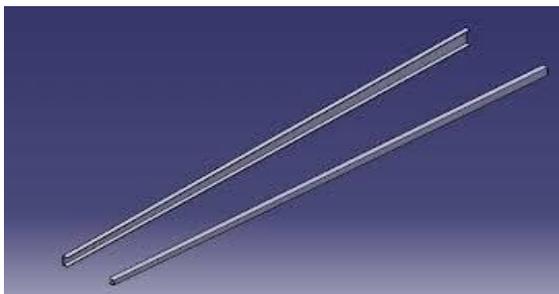


Fig 2. Stringers

1.1.2 Frames

It primarily serve to maintain the shape of the fuselage and to reduce the column length of the stringers to prevent general instability of the structure. Frame loads are generally small and often tend to balance each other and as a result, frames are generally of light construction.

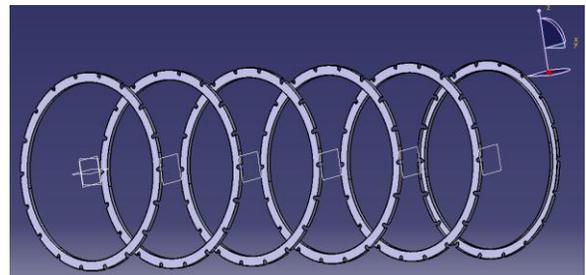


Fig 3. Frames

1.1.3 Bulkhead

They are provided at points of introduction of concentrated forces such as those from the wings, tail surfaces and landing gear. Unlike frames, the bulkhead structure is quite substantial and serve to distribute the applied load into the fuselage skin. Their construction is similar to stringers, just they are very much thicker than frame members.

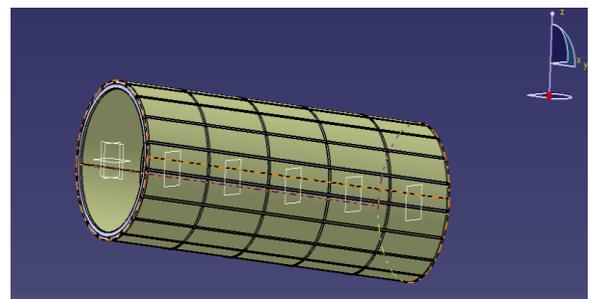


Fig. 4 Bulkhead

1.1.4 Shear-clip

They join stringers to the frame and allows the load path from skin>stringers>shear-clip>frame.

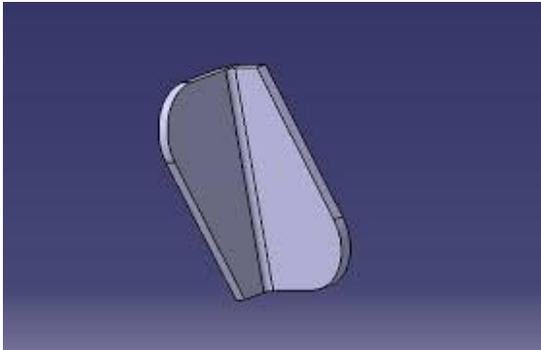


Fig. 5 Shear Clip

2. MATERIAL USED

Table 1, Mechanical Properties of AL 7075

Density	2.81g/cm3
Elastic Modulus (young's modulus)	72 GPA
Tensile Strength: Yield (Proof)	510 GPA
Tensile Strength: Ultimate (UTS)	580 GPA
Strength to Weight Ratio	207 KN-m/kg
Shear Strength	331 MPA

3. DESIGN OF THE MODEL PARTS:-

Construction of frames in Catia V5:-

3.1 Making Skin of the fuselage

- In part design make a circle of (r=1000mm) and then go to generative design and extrude for 3000mm.

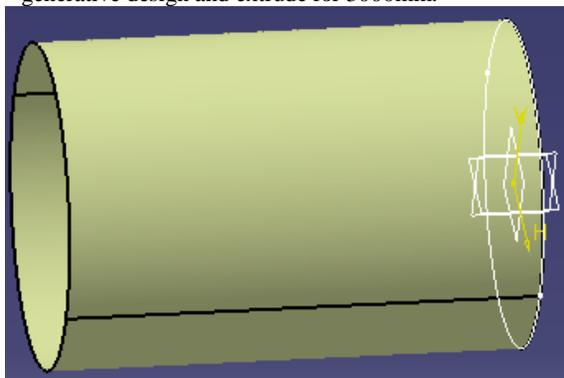


Fig.6 Skin

- Offset the plane in the yz direction at a distance of 3000mm and select planes between command to put the

no. of instances (5) between the reference plane and offset plane.

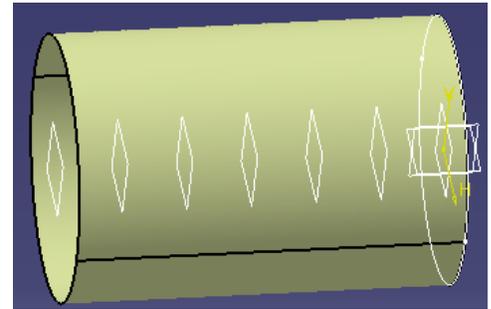


Fig. 7 Planes after offsetting

3.2 Making Stringer of fuselage

- Click on the second plane and create a offset of -8mm .
- Now make a line coinciding center between the offset and besides it draw a rectangle then using constraints constraint the lines 2.5 mm from center line and after that trim the center line.
- Pad the rectangle upto the plane and after that split. First split to inside from the outer skin/offset and in another split ,split to outside from inner skin/offset.
- Now using shell command get the shape of the stringer and then give thickness (1.2mm) to the stringer.
- After this using advanced replication tools>circular pattern create 18 replicas of stringer.

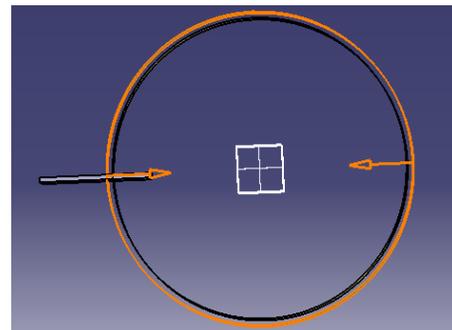


Fig.8 Inside splitting

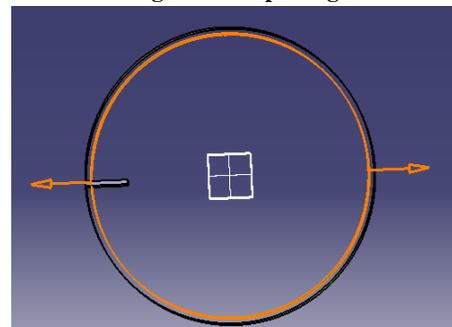


Fig.9 Outside splitting

3.3 Making Frames of Fuselage

- Create offset of 50mm from the outer surface.

- Make a rectangle at reference plane larger than radius of the circle of fuselage and pad it (20mm).
- First split to inside from the outer skin/offset and in another split ,split to outside from inner skin/offset.
- Using shell command remove face 8 and give inside thickness 1.2mm.
- Now make sketch as shown in fig.11 and using pocket command create pocket (upto last).
- After this using advanced replication tools>circular pattern create 18 replicas as of stringers.

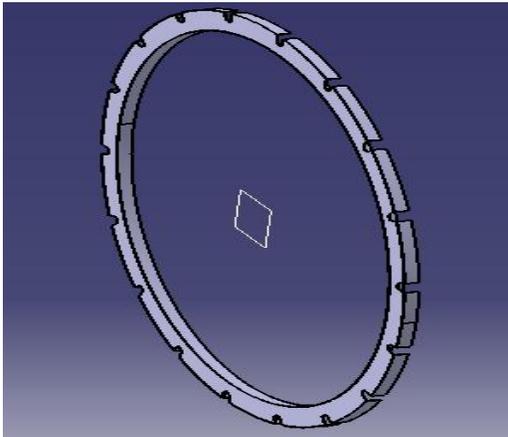


Fig 10. Frame

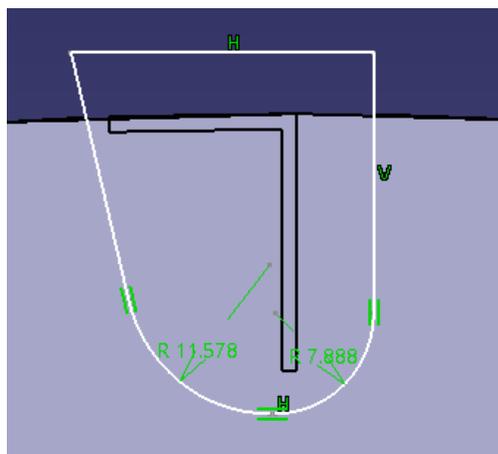


Fig. 11 Sketch for pocket

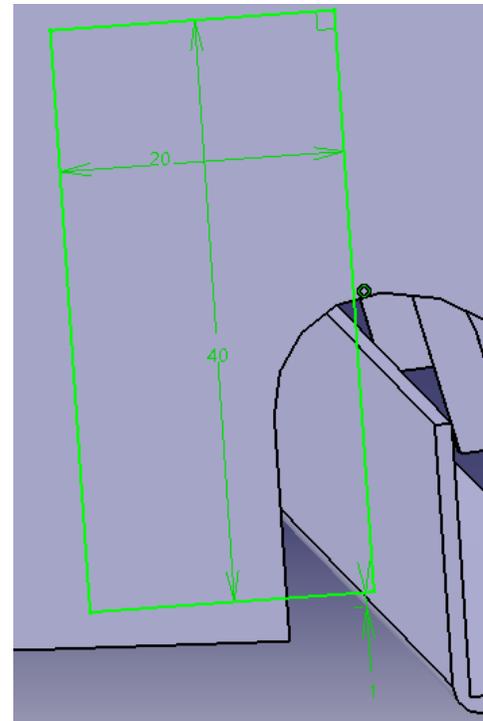


Fig. 12 Sketch for pad

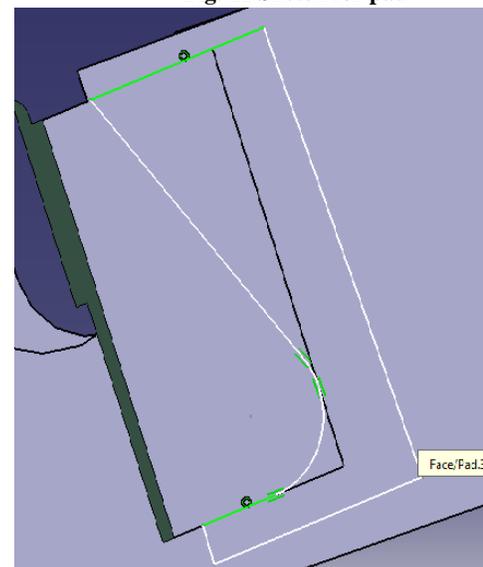


Fig.13 Sketch for Pocket

3.4 Putting Edge Fillet And Shear Clip

- First select the body and then select the plane for which you want to give the edge fillet and then insert>dress up features>edge fillet>radius (according to the body).
- Similarly , do for all the elements.
- Make the figure as shown in fig.12 and pad it for 20 mm. After this use shell and remove the unwanted side. Pocket out the figure as shown in fig.13 and then do it to other side.

4. REFERENCES

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