

CHAPTER 1

1.1 REMOTELY PILOTED AIRCRAFTS

Remotely Piloted aircrafts or RC Aircrafts are small model radio-controlled airplanes that fly using electric motor, gas powered IC engines or small model jet engines. The Airplanes are flown remotely with the help of a transmitter with joysticks that can be used to fly the aircraft and perform different manoeuvres. The transmitter comes also with a receiver which is installed inside the Airplanes which receives the commands send by the transmitter and controls servos. The servos are small motors which are mechanically linked to the control surfaces e.g., ailerons for roll control, elevator for pitch control and rudder for yaw control. The servos moves the control rods (which are small rods that connect the servo to different flight control e.g. to elevator etc) which in turn moves the control surface be it elevator, flaps, aileron or rudder. An RPA can be controlled in flight by using the transmitter from where you can control pitch, yaw and roll of Airplane and can also control the throttle settings. The receiver which accepts the transmitter signal and the servos attached to it are run on rechargeable batteries. Most popular rechargeable batteries for Airplanes use include Ni-Cad (Nickel Cadmium) and Li-Po (Lithium Polymer). Lithium Polymer lasts longer and more powerful than there Ni-Cad counterparts but a bit more expensive.

1.1.1 RPA Propulsion/ Power plants

RC Airplanes fly using either electric motor as propulsion device or IC (internal combustion) gas powered engines or small model jet Engines.

1.1.2 RPA Electric Motors

Electric motors are most used in many model RC Airplanes because of the ease in use. Electric Motors give the advantage of low-cost, easy to use. The throttle of electric motors is controlled using a speed controller which comes with the motor. The speed controller lead is connected to the receiver. The transmitter than can control the throttle of electric motor just as other controls.

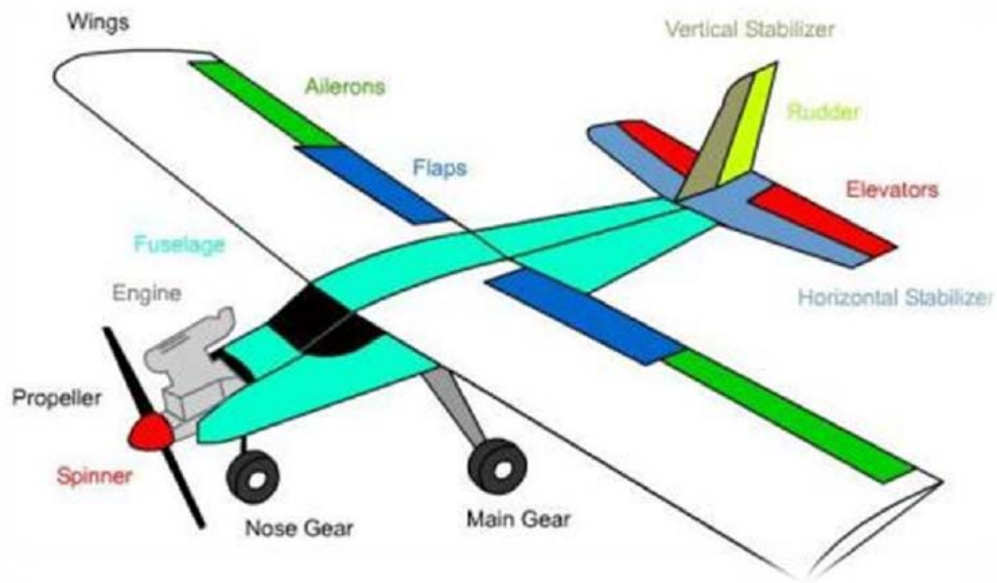


Fig. 1.1 Parts of Remotely Piloted Aircraft

1.2.3 Engine

Engine is the main power-plant of RC Airplane. The power-plant of RC Airplanes can be electric motor, internal combustion gas engines and jet engines. The engine is mounted on the RC Airplanes and provides thrust to the RC Airplanes. Thrust is the forward force necessary for flight. The engines run a propeller.

1.2.4 Engine Cowl

Engine Cowl is the external covering made of fibreglass or plastic material to protect the engine from debris from the ground during takeoff and landing. The engine cowl also makes the RC Airplane more aerodynamically clean.

1.2.5 Propeller

The propeller is basically a wing section made of airfoil sections just like a wing but it is twisted along the span. The propeller is mounted to the

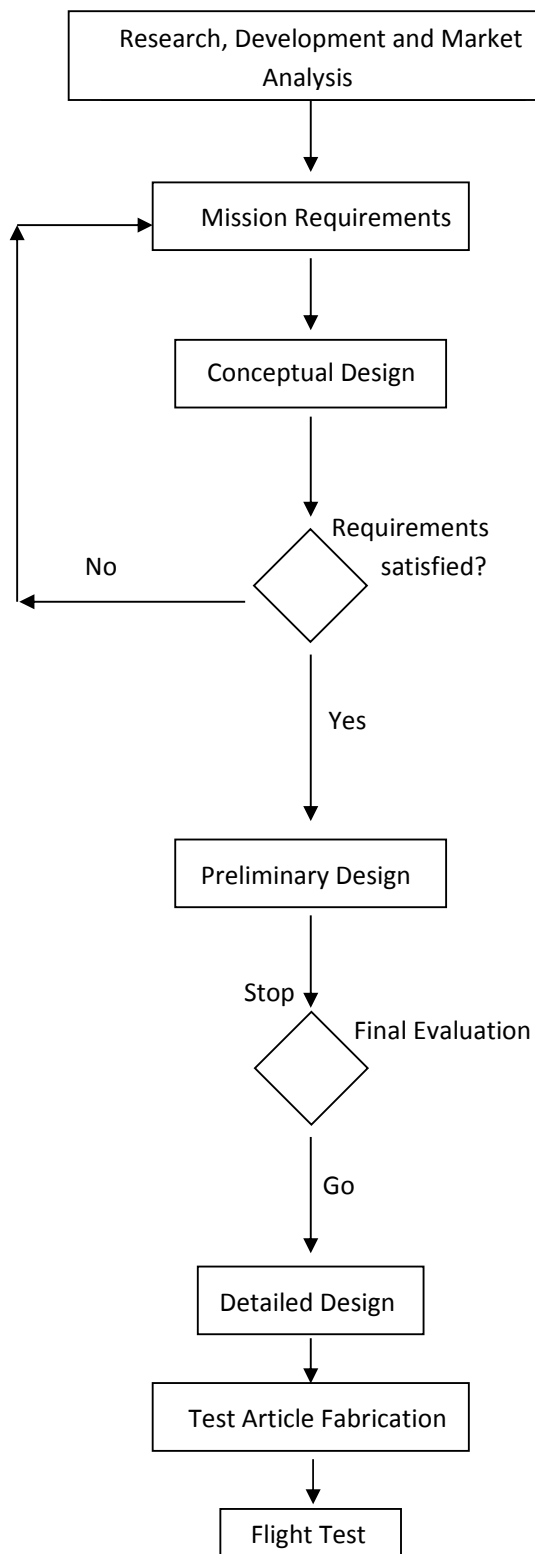


Fig 1.2 Steps in Design

2) Graph stating variation of C_L/C_D

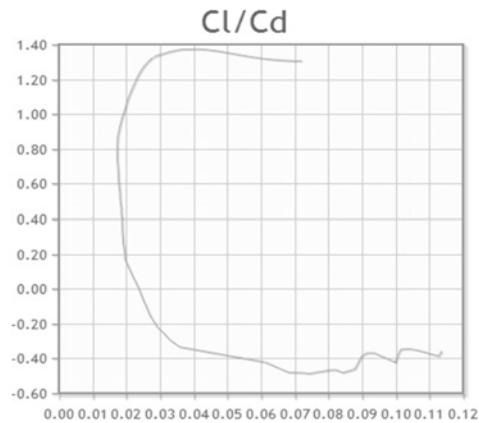


Fig. 4.3 C_L/C_D

Analysis of airfoil using Xflr5

Xflr5 is an interactive program for the design and analysis of subsonic isolated airfoils. Given the coordinates specifying the shape of a 2D airfoil, Reynolds and Mach numbers, Xflr5 can calculate the pressure distribution on the airfoil and hence lift and drag characteristics. The program also allows *inverse design* - it will vary an airfoil shape to achieve the desired parameters.

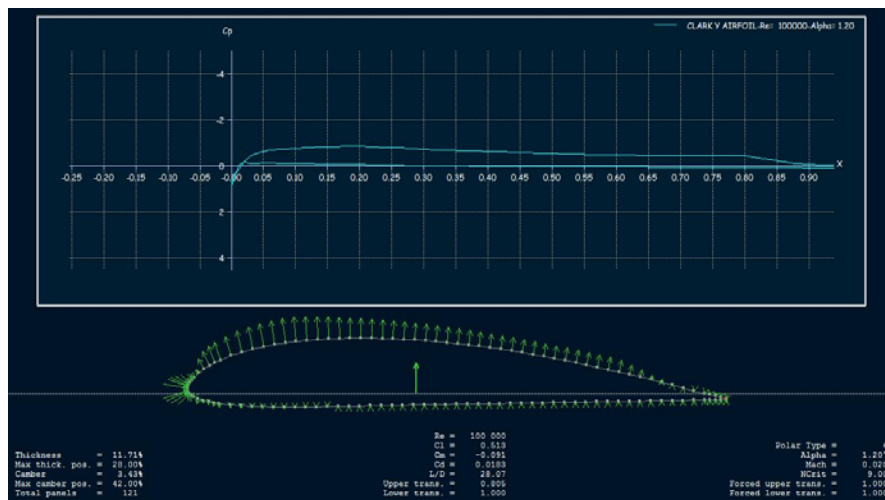


Fig. 4.4 Xflr5 Analysis

CHAPTER 6

6. 3D Designing using CATIA

From the AutoCAD sketching, the 3D design is developed in CATIA V5. Each part has been separately created in part and surface mode and then assembled using the assembly workbench.

6.1 Designing of fuselage:

At first, bottom surface is created & then we create the left & right side face. These sides are then assembled in assembly mode.

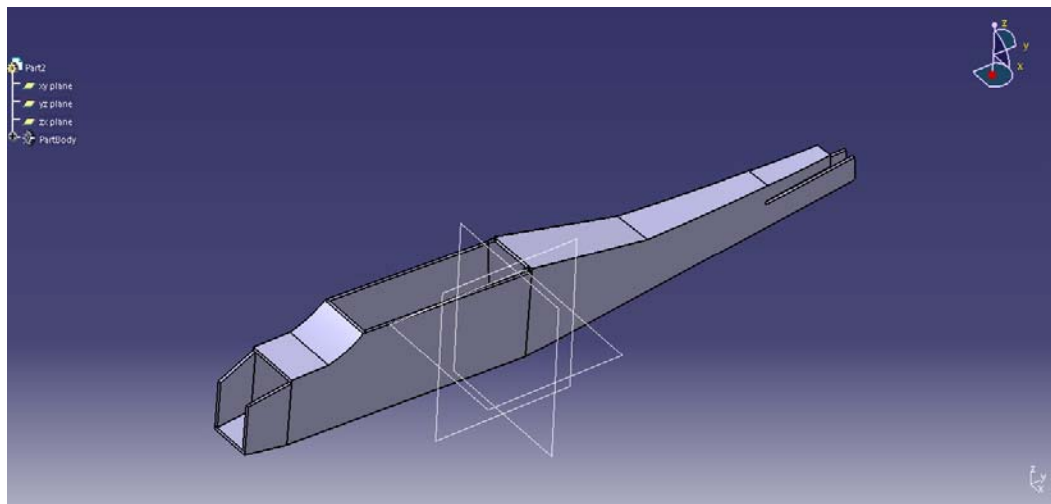


Fig. 6.1 Design of Fuselage

6.2 Designing of wing

In wing design, the first step involves drawing of the Clark Y airfoil using airfoil plotter. The Ribs are formed and are placed at equal offset distance. In total 11 Ribs are placed throughout the span.

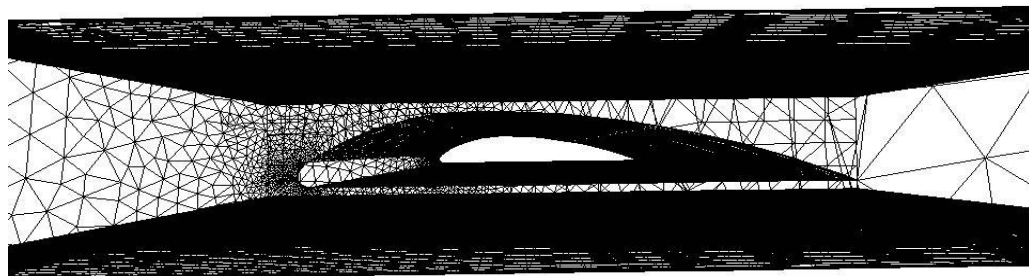
Chapter 7

7. Analysis of wing using ANSYS work bench

Fluent analysis is performed over the wing to capture the stream line flow pattern and also to estimate the velocity vector, pressure distribution, etc

7.1 Meshing

It is the major and most important steps in analysis. The accuracy of the analysis depends on the accuracy of mesh. The mesh should have fine grid spacing.



Z
↓
X—Y

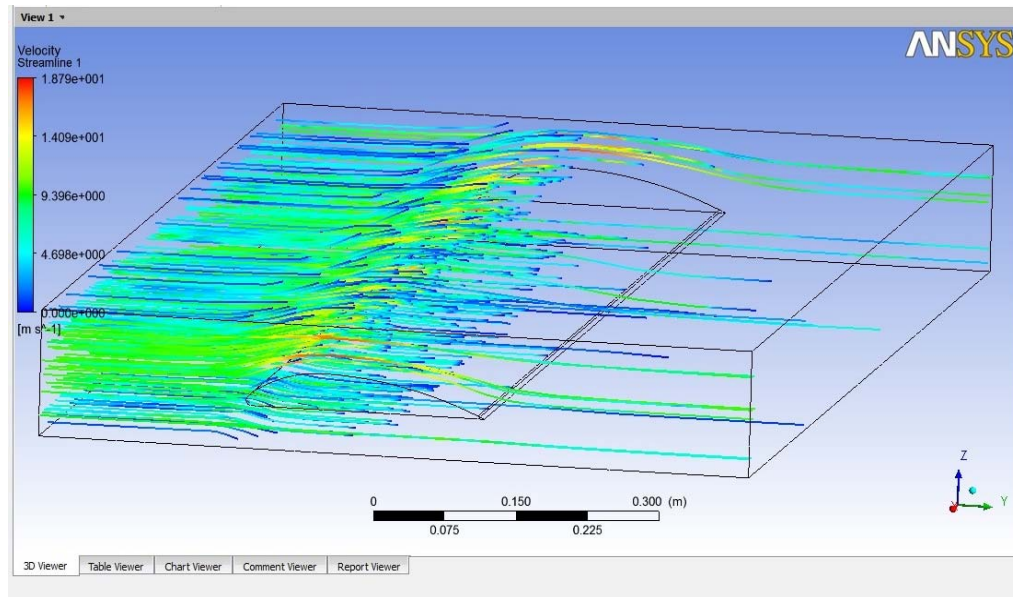
Mesh

Mar 25, 2013
ANSYS FLUENT 12.0 (3d, pbns, lam)

7.4 Flow Analysis

It states the final stream line flow over the defined surface whether the system is in static or dynamic condition.

For our case the wing is kept at static condition.

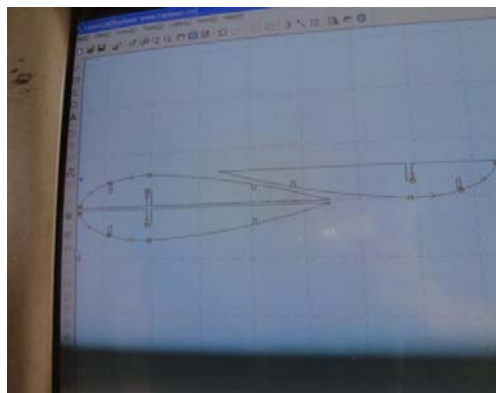


Chapter 8

8. Laser cutting of balsa wood

Laser cutting is a technology that uses a laser to cut materials, and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. Laser cutting works by directing the output of a high-power laser, by computer, at the material to be cut. The material then melts, burns, vaporizes away, or is blown away by a jet of gas, leaving an edge with a high-quality surface finish. Industrial laser cutters are used to cut flat-sheet material as well as structural and piping materials.

One of the most common woodcutting tasks is sawing boards. Traditional hand saws, circular saws and chain saws cannot match a laser for speed and precision. When one uses a laser board cutter, a board is secured, and its intended cut dimensions are programmed. The machine then cuts the board with a high-powered laser exactly where specified. These machines may cut across the grain of a board, but they can also cut along the grain, like a lathe---making them essentially two tools in one





9.5 Assembly

An assembly, the fuselage & the tail portion are installed at first. Wing fixer is installed according to the design. The hinges, linkages & control rods are installed. The servos, motors and the landing gear are fixed.



9.5.1 Installation of Hatches

Weight compensation for hinged doors, hatches, gates, or the like, which swing up and down on an upper horizontal hinge axis, comprises a torsion rod extending parallel to the hinge axis and having hollow shafts or bushings at its respective ends, one of the bushings is connected through a lever and a continuously length adjustable rod to the frame and on one side of said door, hatch, or gate, the other bushing is mounted to a lever,

direction in which the load is acting, and the nature of the load like compression or expansion.

9.5.10 Final Assembly

Once all the parts are fabricated & the electronic components are installed, the wings are attached to the fuselage by using a high strength rubber band.



9.6 Aircraft Specifications

- Wing Span: 150 cm
- Wing Chord: 26 cm
- Wing Area: 4028 cm²
- Airfoil: Clark-Y Airfoil
- Fuselage Length: 105 cm