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OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

MODELING AND STATIC ANALSYIS OF HOVER BIKE USING VARIOUS MATERIALS FINITE ELEMENT METHOD

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Abstract: In this Project, we discuss the future of automobile called as Hover Bike. This is a future evolution of transporting. It is a compact aerial vehicle with a ducted fan configuration which can able to survey and spy the surroundings and also a simple design is used for commercial purposes like a motorbike. Also, it can be used for various field of application area surveillance, material handling, movie industries, military and emergency services. It can have a capacity of single or double seater system. Thrust vectoring can be done by special design and technique so that it can able to fly almost in all directions. It is designed with the ducted fan so that the slip of the air is less. Hence its aerodynamic efficiency is so high. Moreover, it can able to take off and land vertically from any terrain. It does not need any runway. The aim of the project is design of hover bike by using catia software and analysis using ansys software with different materials CFRP AND AL6061 MATERIAL finally concluded the which material is the suitable for the hover bike .

Keywords: *Hover Bike, Design, Static Analysis*

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I INTRODUCTION

1.1Introduction

Today’s aerospace industry focuses on two primary areas transportation and military. The transportation sector focuses on designing larger, more efficient, and more reliable aircraft. The military focuses on designing more effective, maneuver, and deadly weapons. There is also a private sector in the aerospace industry. Small single engine planes, new helicopters, and other unique flying devices all fall into this category. Beyond the private sector, there are also several commercial applications that could benefit greatly from the hover bike. A hover bike is a combination between a motorcycle and a helicopter. It looks like simple bikes. This ducted-fan type bike is easy to operate and can be applied to various purposes because it does not need a runaway and is capable of hovering from any terrain. It would be able to take off and land vertically, for this reason, the military has shown continued interest in ducted-fan vehicles. A ducted-fan bike is mobile and can be deployed rapidly, which makes it well-suited for a variety of missions such as reconnaissance and surveillance performed by soldiers at the platoon or squad level. Also, it is aerodynamically efficient because the lift generated by the duct can create a thrust force that is higher than the other VTOL vehicles, which have no duct and therefore no hovering flight mode Ideally, such a vehicle would be able to allow people to navigate the earth in a new and unique way. Some test prototypes are in development but no commercial hover bike has been built yet.

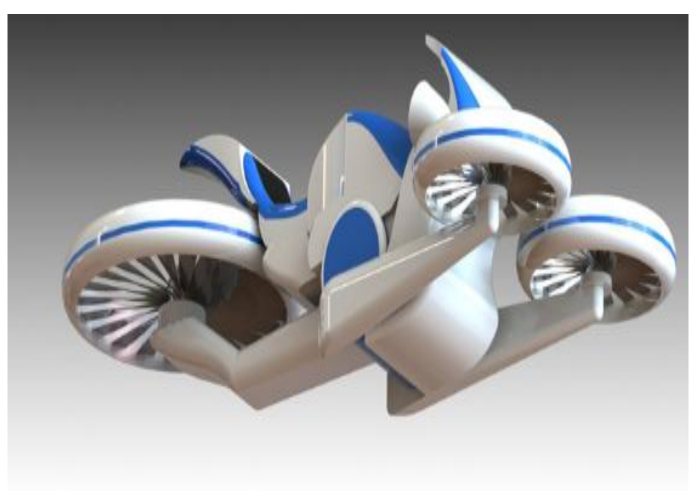

Figure 1 Hover bike

A hover bike can be defined as a combination between a motorcycle and a helicopter. Ideally, such a vehicle would be able to allow people to navigate the earth in a new and unique way. A well-designed hovercraft would be able to take off and land vertically, maneuver slowly through tight spaces, and hover in place. To date, no commercially viable hover bike has been built, though some test prototypes do exist and are in development. Our goal is to produce an extremely reliable helicopter, designed with rugged simplicity at its heart and true pilot safety built into the design and operation of the aircraft. Nothing we are doing is new. We are not developing any new component or system that has not been designed and thoroughly tested before. If we are doing anything new it is the combination of existing systems. We believe that the best step forward is just that – a single step forward.

1.2 BACKGROUND

1) A hovercraft is a vehicle that is hovering just above the ground or over snow or water by a cushion of air. In a hovercraft a similar cushion of air is maintained by pumping in a steady air supply, to keep pace with the linkage round the sides.

2) There is always some leakage because the craft has to be free to move, but the designers use various methods to keep leakage as small as possible so that only minimum power is required to keep up the air supply. There are various ways of creating of air cushion and reducing leakage.

3) When the fan rotates, the air pressure is pushed inside the skirt to create lifting and the hovercraft hovers with almost no friction. A well designed hovercraft has much better performance than the normal boat because it has less drag and requires less horsepower to move. This condition results higher speed and less fuel consumption.

4) The hovercraft gets above twice the fuel mileage of a boat with similar size or capacity. The medium scaled hovercraft also works very well in water where the standing waves up to a meter high. By using the concept and equation of Bernoulli, the volumetric flow rate of the hovercraft fan can be obtained.

5) The first hovercraft is produced ever in Malaysia was by AFE manufacturing company with Japanese technology collaboration. The launching of the hovercraft in PUTRAJAYA in 2003 has paved way for new opportunity in manufacturing sector.

1.3 ADVANTAGES

- Cost is low comparatively Putrajaya hovercraft and Robinson R22.
- Ability to take off and land vertically.
- No need of runway. -Hover-craft is maintain conservation of fuels.
- The hover bike would be able to reach some areas inaccessible to road vehicles and helicopters.
- From this the traffic problems can be reduced.

II LITERATURE REVIEW

Kailas Gaware et.all[1](2018) concluded that Adventurous motorcyclists might be familiar with the thrill of getting airborne at the top of a rise, but the Hover Bike was set to take catching some air to a whole new level. When compared with a helicopter, the Hover bike was cheaper, so that cheaper better product will not only take over the existing market but also its open the way for those people whose not afford the costs of a typical helicopter [1].

Ninad R. Patil et.all[2] (2017) concluded that the Original hover bike uses IC engine as a power source but they was proposing electric energy as a power source. So there was a contribution towards pollution control. The only disadvantage will be its high initial cost [2].

Umesh Carpenter et.all[3] (2017) analysed that the Hover bike has been designed from the very beginning to replace conventional helicopters in everyday one man operational areas like cattle mustering and survey, not just for the obvious fact that it was inefficient and dangerous to place complex conventional helicopters in such harsh working environments but also from a practical commercial position in which bringing to market a cheaper better product will not only take over the existing market but can open it up to far more new customers who before could not afford the upfront costs of a typical helicopter and the very expensive and often unlooked for maintenance costs [3].

Purushottam Jadhav et.all[4] (2016) concluded the advantage of hover bike or hover-craft was maintain conservation of fuels. The mechanical part was the most challenging issue. The hull of the model was made from the polystyrene due to light, low cost and easy to shape. It had high aerodynamic efficiency due to ducted fan arrangement [4].

Swaraj D. Lewis et.all[5] (2016) concluded that it could fly at a range of around 800m, endurance of maximum 5-10 minutes, payload obtained in case of two blade propeller was 0.3kgs and in case of three blade propeller was 0.5kgs [5].

III PROJECT OVERVIEW

3.1 OBJECTIVE OF THE PROJECT:

- 1. Design of the hoverbike different materials viz., using Catia software
- 2. Determination of linear stresses, strains, deformations, shear stresses and deformation using static structural analysis.
- 3. Meshing of design model using ANSYS 14.5.

- 4. Analysis of hover bike apply lift and drag forces static analysis
- 5. Comparing the performance of design different Materials (composite materials)in static structural analysis

3.2 METHODOLOGY:

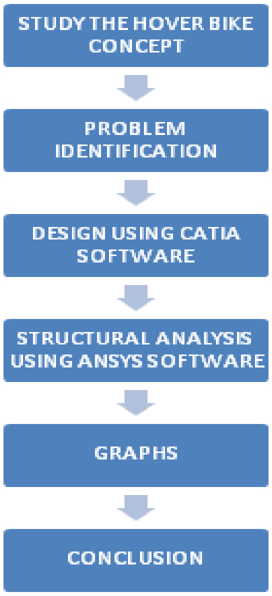

FIG2: METHODOLOGY

3.3DESIGN CONSIDERATIONS CONCEPT

The conceptual design phase included primarily the determination of the general layout and design of the next-generation hover bike. The first step in this phase was the identification of design goals. After some search we decided upon the following fundamental vehicle requirements:

• Ability to hover

• Maneuverability in all directions about hover

• Endurance of no less than ten minutes – ten minutes was judged a practical minimum to allow for sufficient useful flight time between takeoff and landing

• Sufficient control effort beyond hover to ensure a controllable vehicle.

• Onboard power supply and processing – realistic applications would not allow tethersIn addition to these primary requirements, the following qualities were identified as desirable if achievable without detriment to the primary requirements:

• Electric power supply – preferable for ease and safety of use and quiet, indoor operation (I use motor engine instead of electric motor for more thrust)

• High residual thrust to hover thrust ratio –an acrobatic vehicle was desirable for its ability to demonstrate controllability in difficult to perform maneuvers

• Minimal cost and complexity.

3.4 MATERIAL PROPERTIES

3.4.1CARBON FIBER:

A Carbon Fiber Chassis is when carbon fiber is used to build the chassis or the frame of a vehicle instead of the usual choice of metals. A chassis, being the frame of the vehicle has to be rigid or strong to absorb and retain movements and vibrations from the engine, suspension and axles. It should also be as light as possible to improve the vehicle's performance and fuel efficiency.

Properties	Carbon Fiber[14]
Possion's Ratio	0.10
Density (g/cm^3)	1.60
Yield Strength (MPa)	450
Compressive Yield Strength(MPa)	570
Ultimate Tensile Strength (MPa)	600
Young's Modulus (GPa)	110
Thermal Expansion ($10^6 \times K^{-1}$)	2.10
Thermal Conductivity (W/mk)	180

Figure 3 Carbon fiber material properties

A carbon fiber chassis is used on performance oriented vehicles because they are approximately twice as rigid, significantly stronger but is much lighter than a steel or aluminium panels. A carbon fiber chassis is always some sort of monologue design with stronger and weaker areas similar to using different alloys in metal. Carbon Fiber also called carbon fiber reinforced plastic (CFRP) is a composite material that is used for several purposes in and out of the automotive industry.

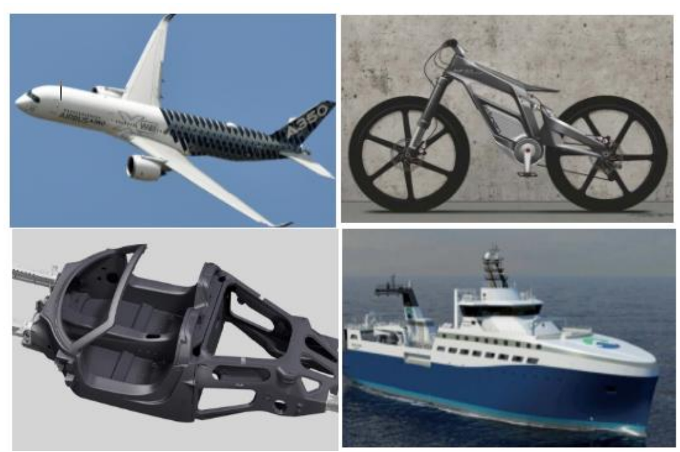

Figure 4 carbon fiber applications of various fields

3.4.2 AL6061 MATERIAL:

6061 is a precipitation-hardened aluminum alloy, containing magnesium and silicon as its major alloying elements. Originally called "Alloy 61S", it was developed in 1935.It has good mechanical properties, exhibits good weldability, and is very commonly extruded (second in popularity only to 6063). It is one of the most common alloys of aluminum for general-purpose use.

Properties	6061 MATERIAL
Possion's Ratio	0.3
Density(g/cm^3)	2.7
Yield Strength(Mpa)	276
Shear modulus(Gpa)	26
Ultimate Tensile Strength(Mpa)	310
Young's Modulus(Gpa)	68.9

Figure 5 Material properties of AL6061

IV.DESIGN PROCEDURE IN CATIA:

Go to the sketcher workbench create the frame as per above dimension after go to the part design work bench apply pad as per above dimensions now create the rotating rotors in sketcher workbench using circles after go to part design apply pad after go to the sketcher workbench create the outer frame of hover rotors as per dimensions after create the propellers apply rectangular pattern in part design after assembly all parts using constraints in assembly workbench.

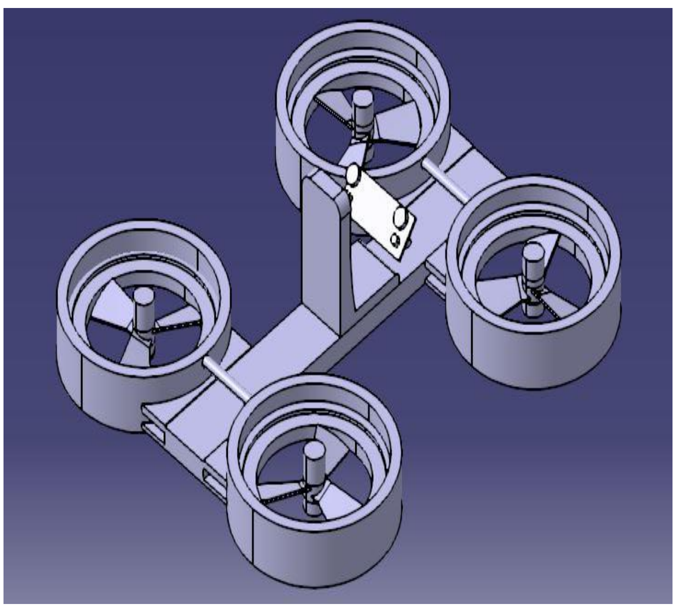

Figure 6 Hover bike in Catia model

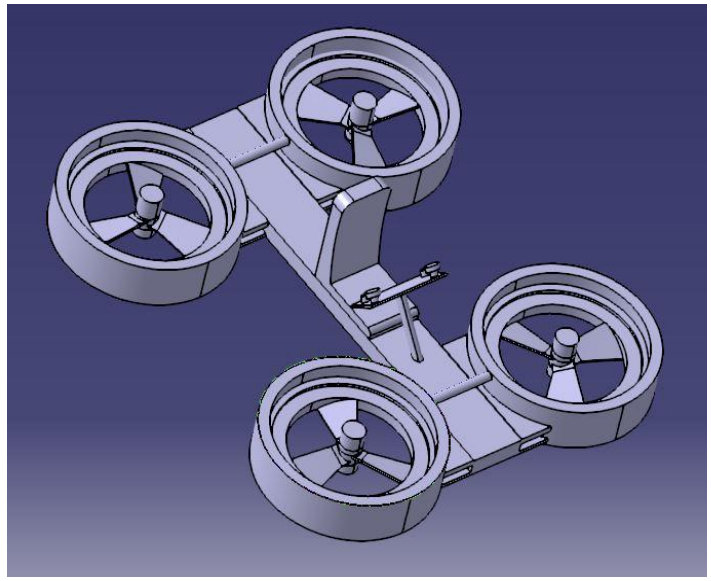

Figure 7 Hover bike in Isometric view

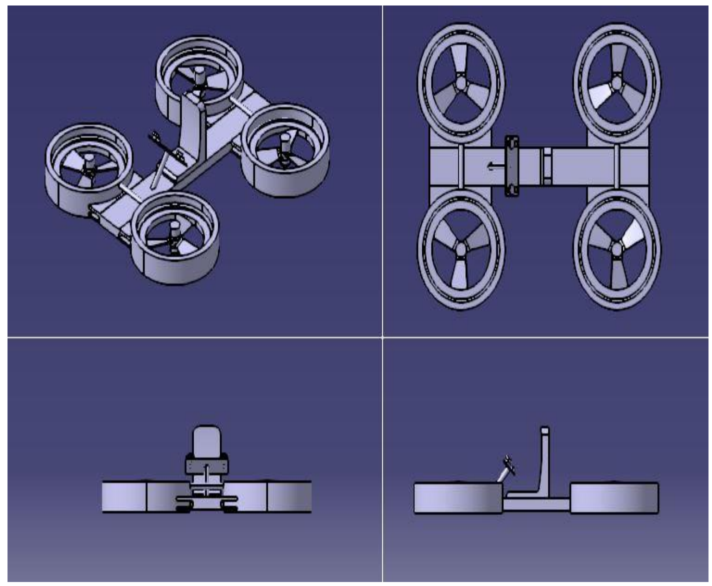

Figure 8Multi views in catia workbench

V INTRODUCTION TOANSYS

ANSYS is a large-scale multipurpose finite element program developed and maintained by ANSYS Inc. to analyze a wide spectrum of problems encountered in engineering mechanics**.**

5.1 PROGRAM ORGANIZATION:

The ANSYS program is organized into two basic levels:

- Begin level
- Processor (or Routine) level

The Begin level acts as a gateway into and out of the ANSYS program. It is also used for certain global program controls such as changing the job name, clearing (zeroing out) the database, and copying binary files. When you first enter the program, you are at the Begin level.

At the Processor level, several processors are available. Each processor is a set of functions that perform a specific analysis task. For example, the general pre-processor (PREP7) is where you build the model, the solution processor (SOLUTION) is where you apply loads and obtain the solution, and the general postprocessor (POST1) is where you evaluate the results of a solution. An additional postprocessor, POST26, enables you to evaluate solution results at specific points in the model as a function of time.

5.2MATERIAL MODELS:

ANSYS allows several different material models like:

- Linear elastic material models (isotropic, orthotropic, and anisotropic).
- Non-linear material models (hyper elastic, multi linear elastic, inelastic and

  Visco elastic)
- Heat transfer material models (isotropic and orthotropic)
- Temperature dependent material properties andCreep material models.

5.3LOADS:

The word loads in ANSYS terminology includes boundary conditions and externally or internally applied forcing functions, as illustrated in Loads. Examples of loads in different disciplines are:

- **Structural**: displacements, forces, pressures, temperatures (for thermal strain),

  Gravity.
- **Thermal**: temperatures, heat flow rates, convections, internal heat generation,

  Infinite surface.
- **Magnetic**: magnetic potentials, magnetic flux, magnetic current segments, source current density, infinite surface.
- **Electric**: electric potentials (voltage), electric current, electric charges, charge Densities, infinite surface
- **Fluid**: velocities, pressures Loads are divided into six categories: DOF constraints, forces (concentrated loads), surface loads, body loads, inertia loads, and coupled field loads.

VI RESULT AND DISCUSSION

6.1RESULTS AND DISCUSSION

Design and analysis is done Our project is based on a concept of flying machine which is a revolution in aviation. Hoverbike is similar to helicopter but can be manufactured in less cost and much more compact in size. Conventional materials is the more weight this project we introduced composite material CFRP applied the lift forces finally we concluded the which material is the suitable for the hover bike as shown below figures

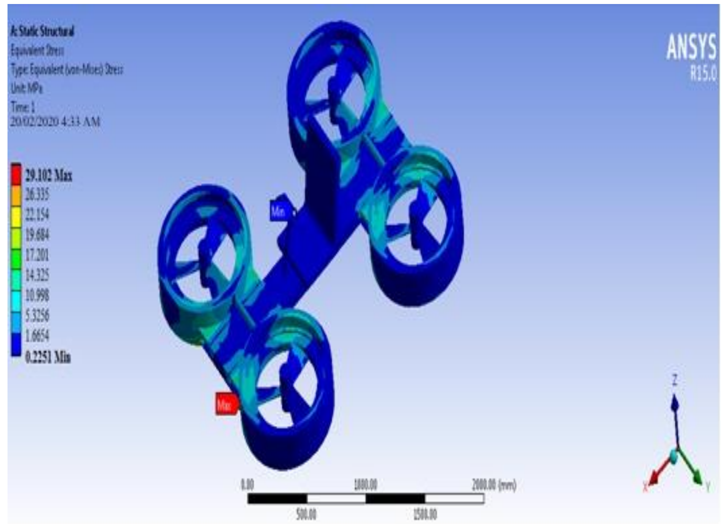

Figure 9 VON-MISES STRESS OF AL 6061 MATERIAL

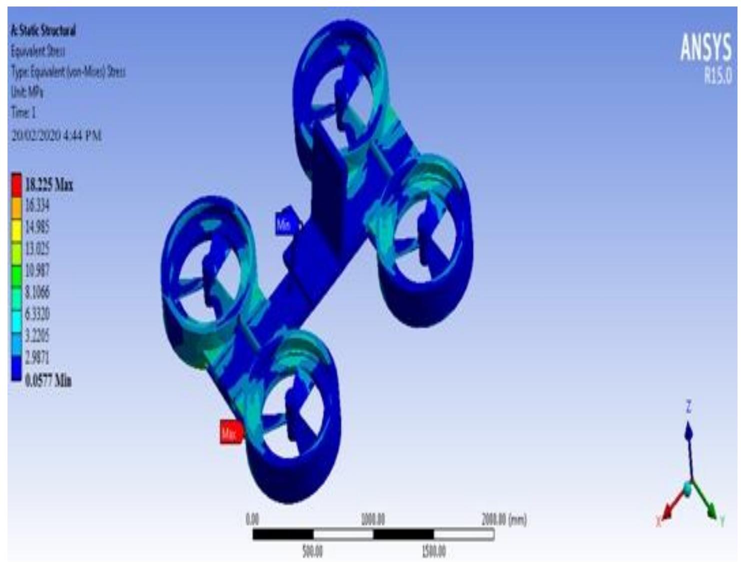

Figure 10 CFRP MATERIAL

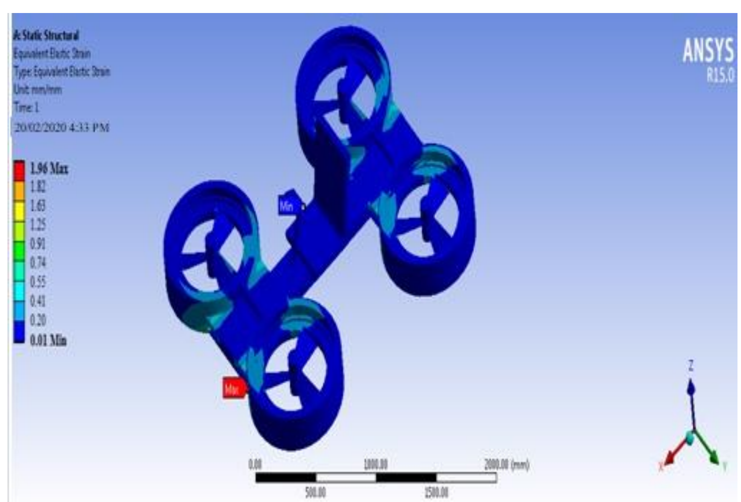

Figure 11 STRAIN OF AL 6061 MATERIAL

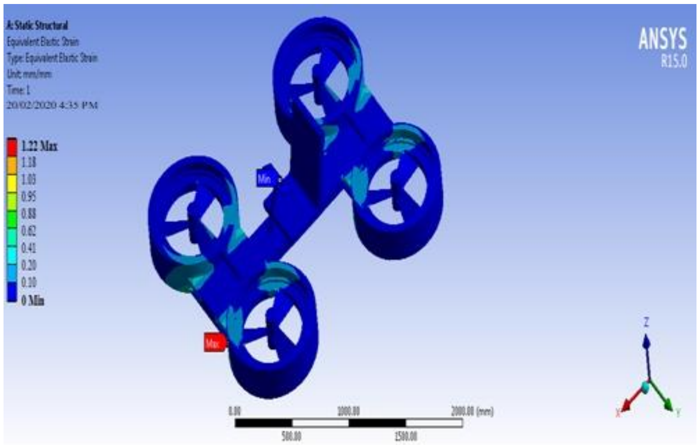

Figure 12 STRAIN OF CFRP MATERIAL

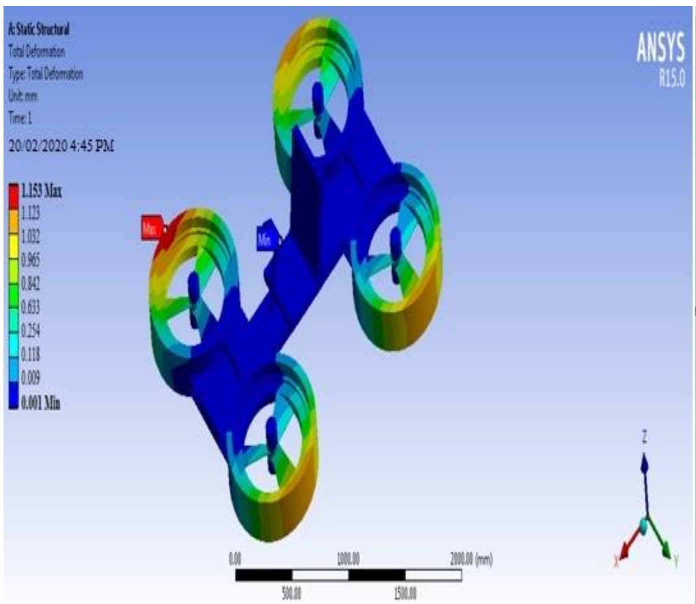

Figure 13 TOTAL DEFORMATION OF AL6061 MATERIAL

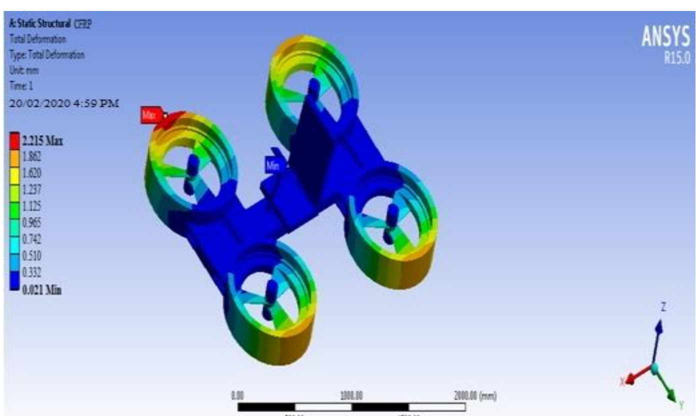

Figure 14 TOTAL DEFORMATION OF CFRP MATERIAL

6.2GRAPHS

6.2.1.VON-MISSES STRESS: we can observe case of equivalent (von-mises) stress, hover bike with different materials CFRP AND Al6061 we found to have least stress of 18.22MPa in comparison with AL6061 Material is observed as shown below figure.

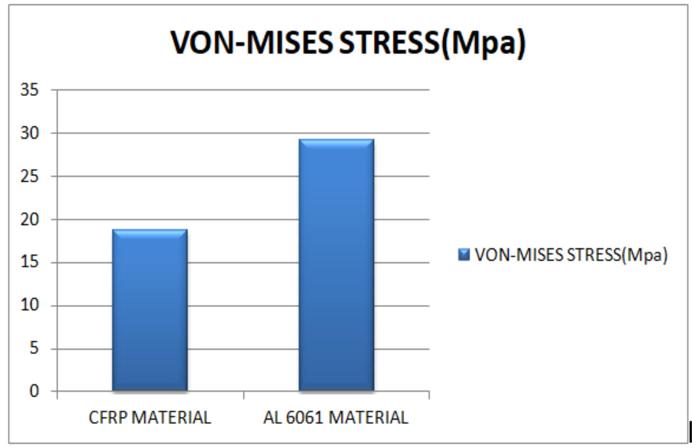

Figure 15Von-mises stress Graph

6.2.2 TOTAL DEFORMATION **:** we can observe case of equivalent Total deformation hover bike with different materials CFRP AND Al6061 we found to have least Total deformation of 0.62mm in comparison with AL6061 Material is observed as shown below figure.

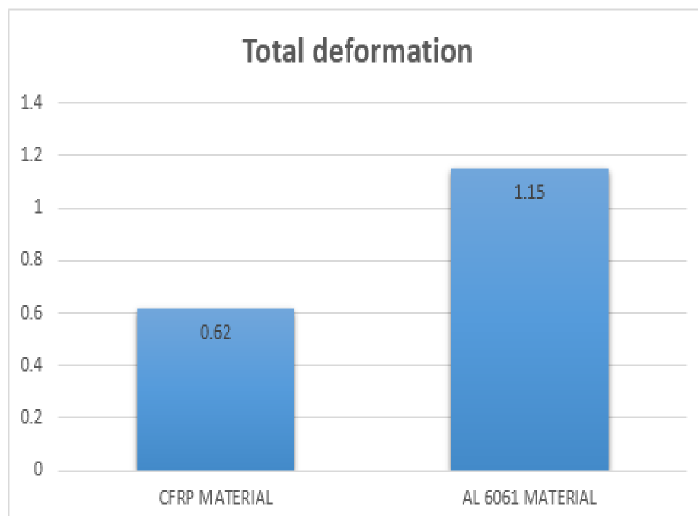

Figure 16Total deformation graph

6.2.3 STRAIN: we can observe case of equivalent strain hover bike with different materials CFRP AND Al6061 we found to have least strain of 1.22 in comparison with AL6061 Material is observed as shown below figure

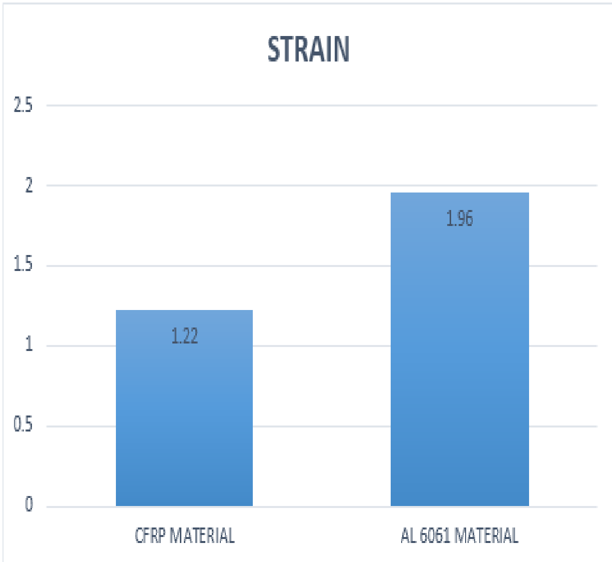

Figure 17 Strain graph

VII CONCLUSION

Design and analysis is done of hover bike reduced the wait also using the composite material The present research work is concluded that such type of bike is the need of today. HoverBike is a new, fun & safe mode of transport that virtually anyone can drive. Adventurous motorcyclists might be familiar with the thrill of getting airborne at the top of a rise, but the Hoverbike is set to take catching some air to a whole new level. When compared with a helicopter, the Hover bike is cheaper, more rugged and easier to use – and represents a whole new way to fly. When compared with a helicopter, the Hover bike is cheaper, more rugged and easier to use – and represents a whole new way to fly. So that cheaper better product will not only take over the existing market but also its open the way for those people whose not afford the costs of a typical helicopter. It is the symbol of future bike Finally concluded the cfrp material is the suitable for hover bike chassis because less stress ,strain and deformation.

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