Design and Analysis of Flat Bottom Fixed Wing for UAV

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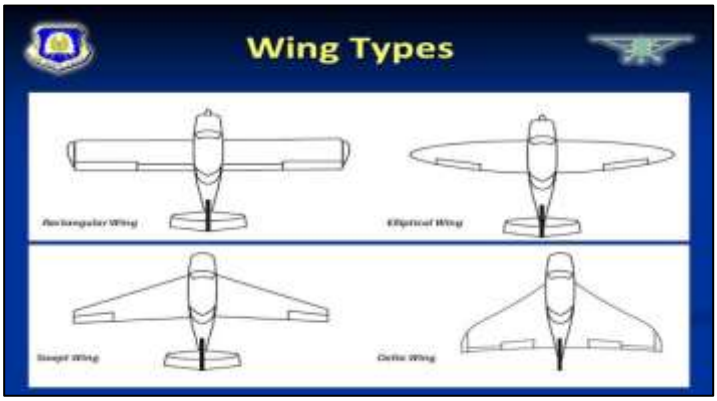
ABSTRACT

This paper presents the model design and analysis of a flat bottom fixed wing for UAV (unmanned Aerial vehicle) with reference of NACA-4412, the design is developed to obtain high stability and minimum controlling effort. The model is developed and model analysis are performed by using commercially available packages AutoCAD and ANSYS respectively. Design is tested for high performance of UAV, enhancing safety, reliability and effectiveness of flight operations. The results of theoretical calculations are compared with the numerical model analysis.

KEYWORDS: *UAV, NACA-4412, HIGH PERFORMANCE UAV, MODEL ANALYSIS.*

INTRODUCTION

WING: A rigid horizontal structure that projects from both sides of an aircraft and supports it in the air. wing is a type of fin that produces lift while moving through air or some other fluid.



VIBRATION

Vibration is oscillating, reciprocating, or any other periodic motion of a rigid or elastic body forced from a position or state of equilibrium. If the frequency and magnitude of vibration are constant, the vibration is said to be harmonic. When the frequency and magnitude vary with time, the vibration is random. Buffet is a form of vibration usually caused by aerodynamic excitation. It usually is random and associated with separated airflow.

LITERATURE REVIEW:

Experimental Vibration Analysis of a Composite UAV Wing:

This paper describes the details of an experimental investigation focusing on vibration characteristics of a carbon composite ultralight unmanned aerial vehicle (UAV). Modal characteristics of the UAV wings are obtained and compared for two separate configurations: 1) wings mounted on the suspended aircraft to simulate a free-free arrangement and 2) a single wing mounted vertically in a fixture to test in a shaker-table approach.

Vibration analysis of a UAV multirotor frame: Recent years have seen a huge increase in the development and use of small unmanned aircraft, otherwise known as drones or Unmanned Aerial Vehicle (UAV). A lot of published research work focusses on new applications, control optimization and flight range maximization.

Vibration Analysis of Structures using a Drone (UAV) based Mobile Sensing Platform:

The identification of the dynamic behaviour of structures, like bridges and towers, is relevant to address multiple issues. In many cases the dynamic parameters should be acquired only once or at a frequency that doesn't justify the installation of distinct vibration sensors for a long-term monitoring.

METHODOLOGY:

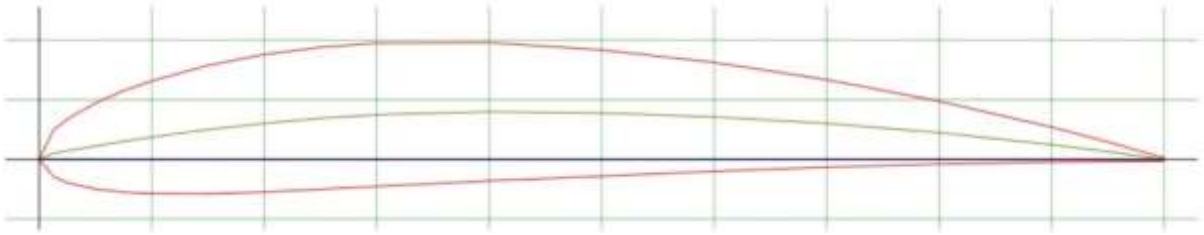
MODELLING OF WING:

The performance and operation of any aircraft are fundamentally dependent upon the type of wing, its parameters, and characteristics. Hence, the wing of an aircraft is the most important part of an aircraft structure.

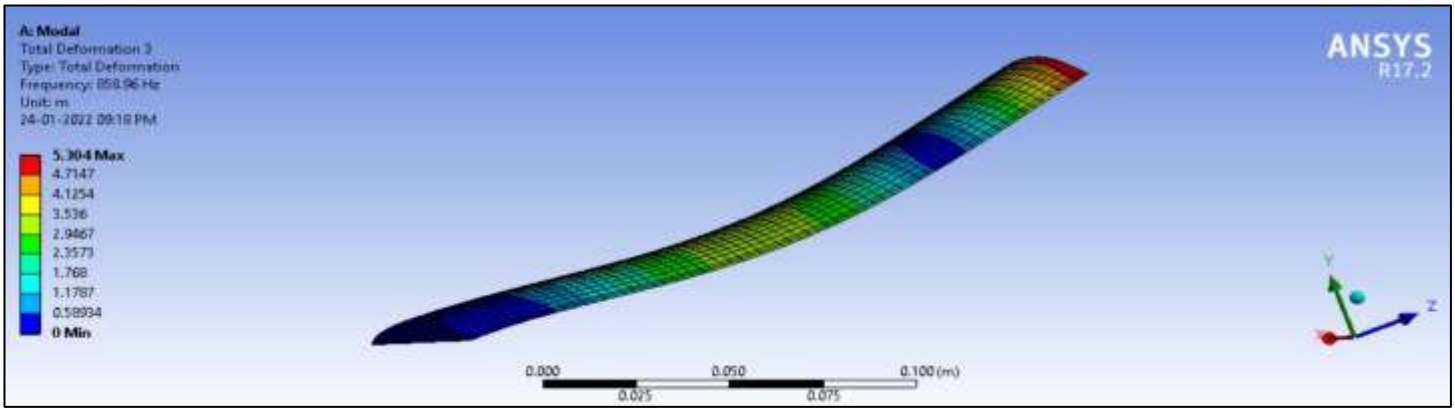
NACA 4412 aerofoil

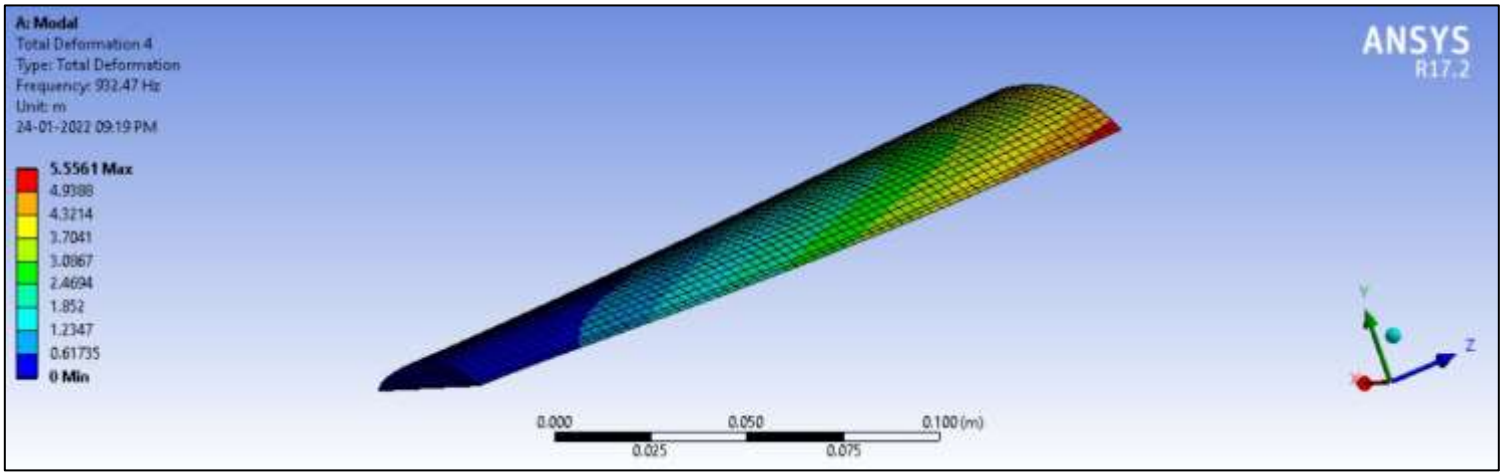
Max thickness 12% at 30% chord.

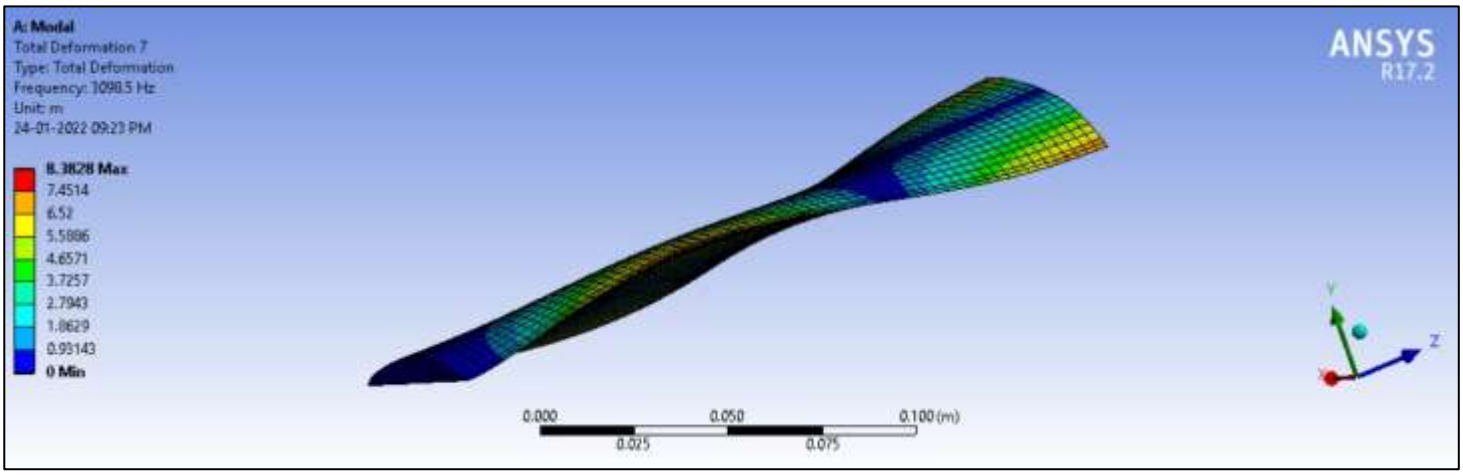
Max camber 4% at 40% chord.



NACA 4412 AIRFOIL



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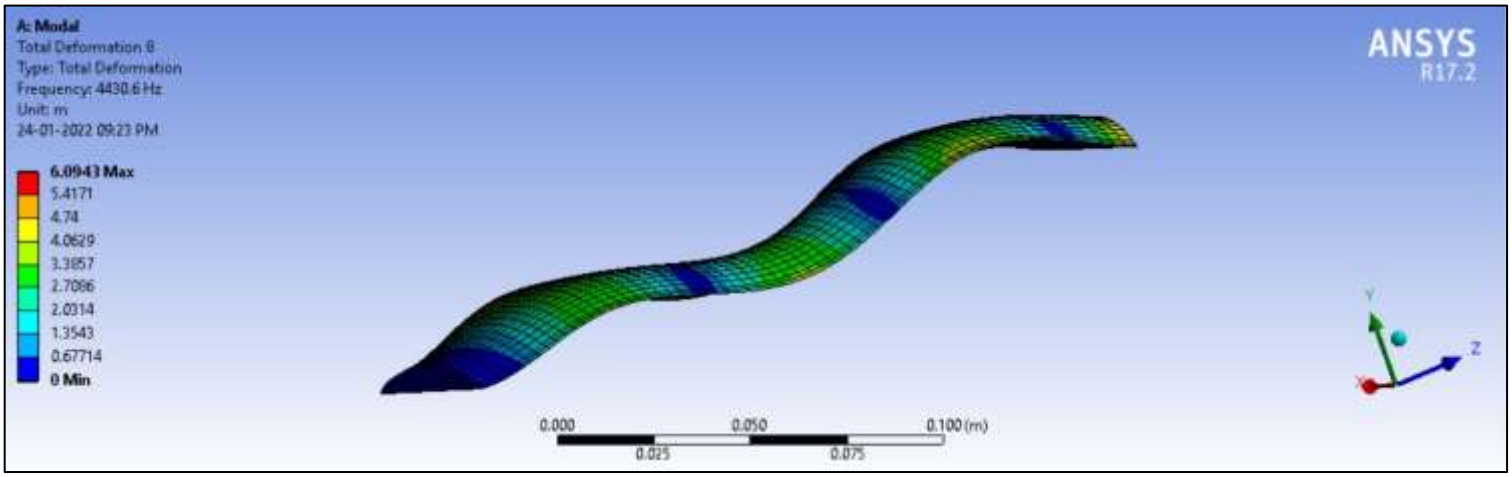
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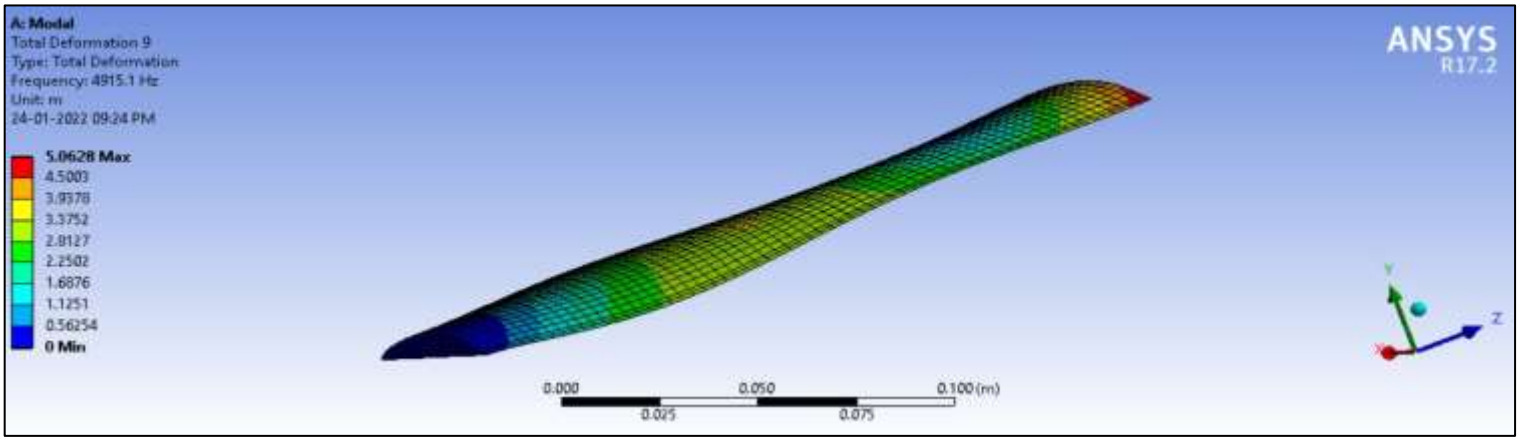
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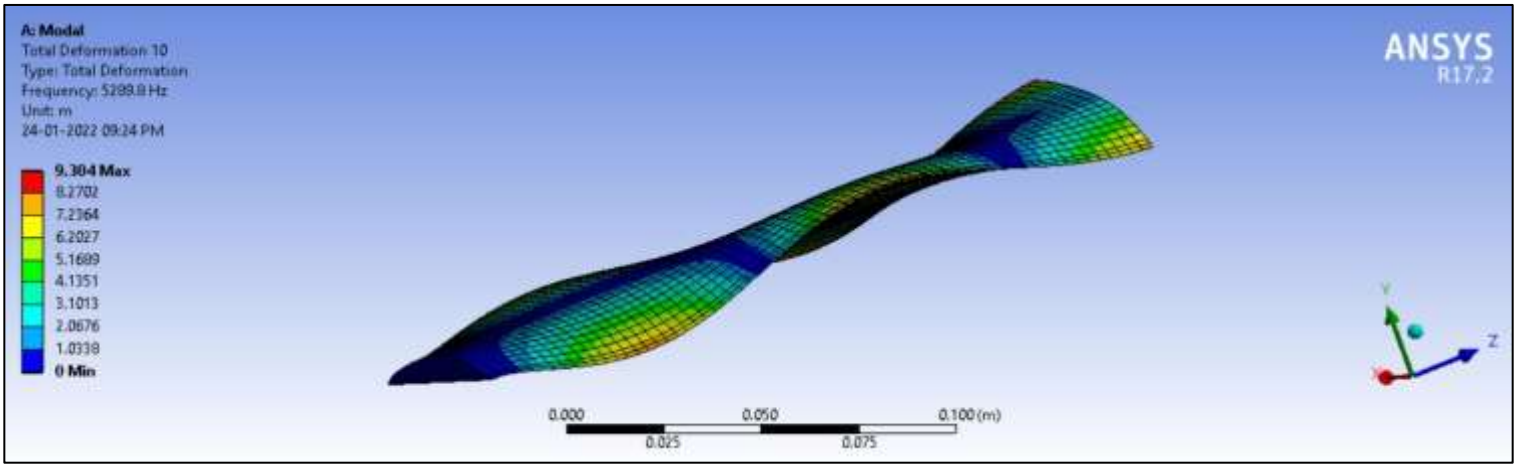
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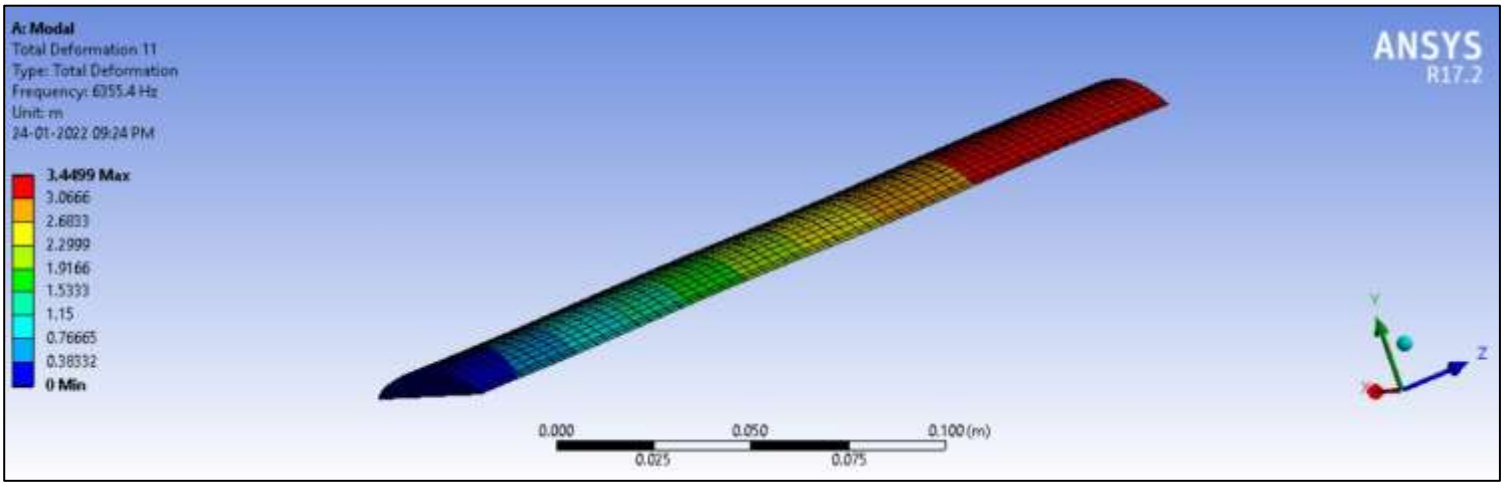
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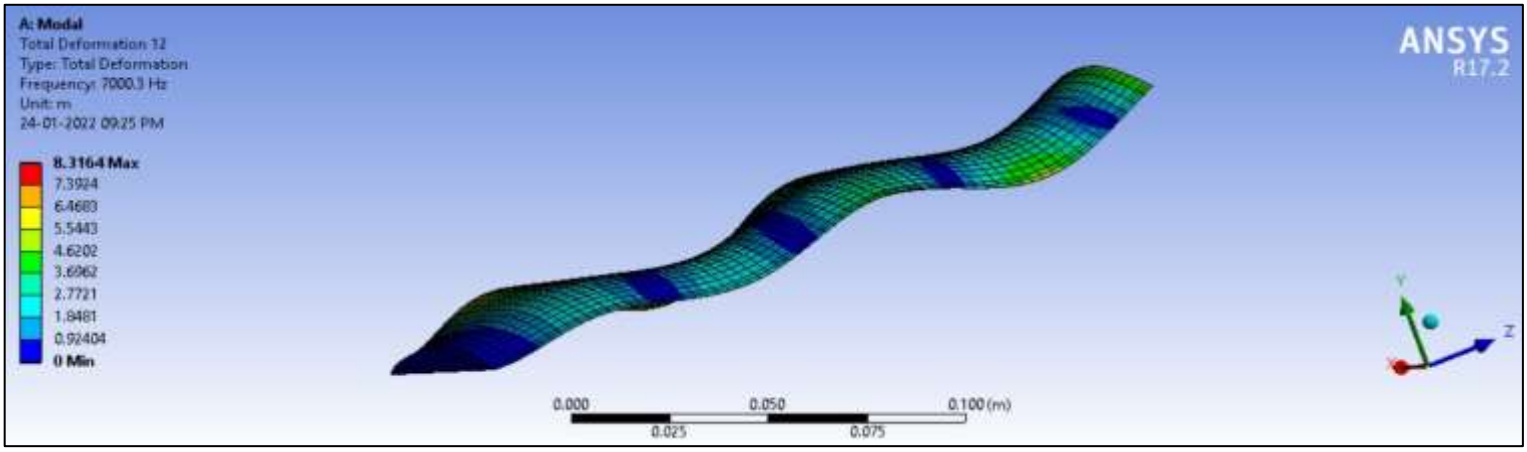
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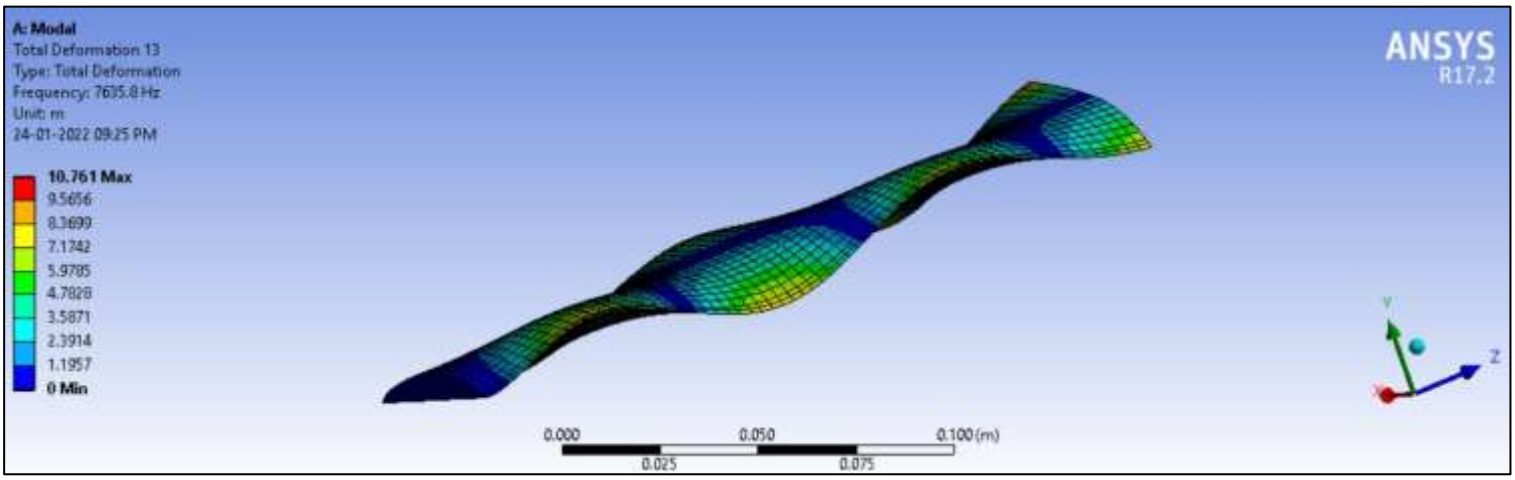
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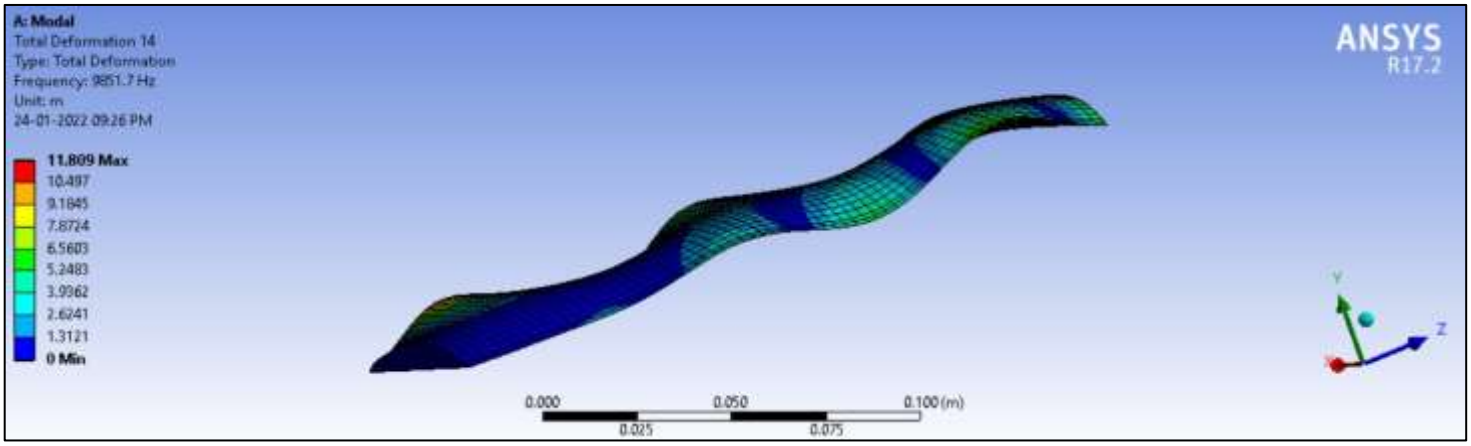
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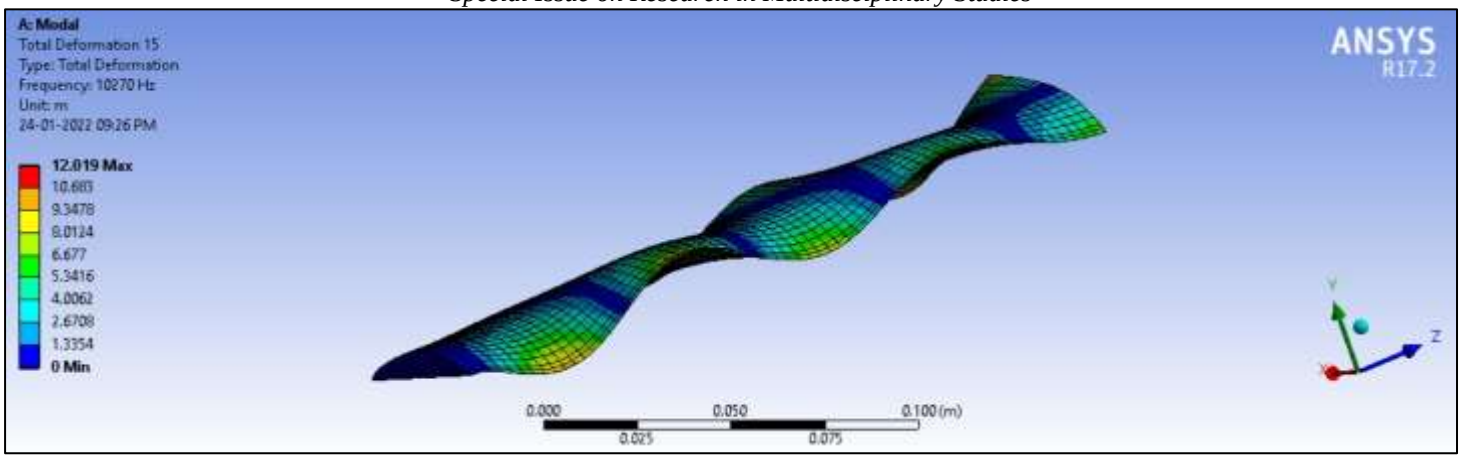

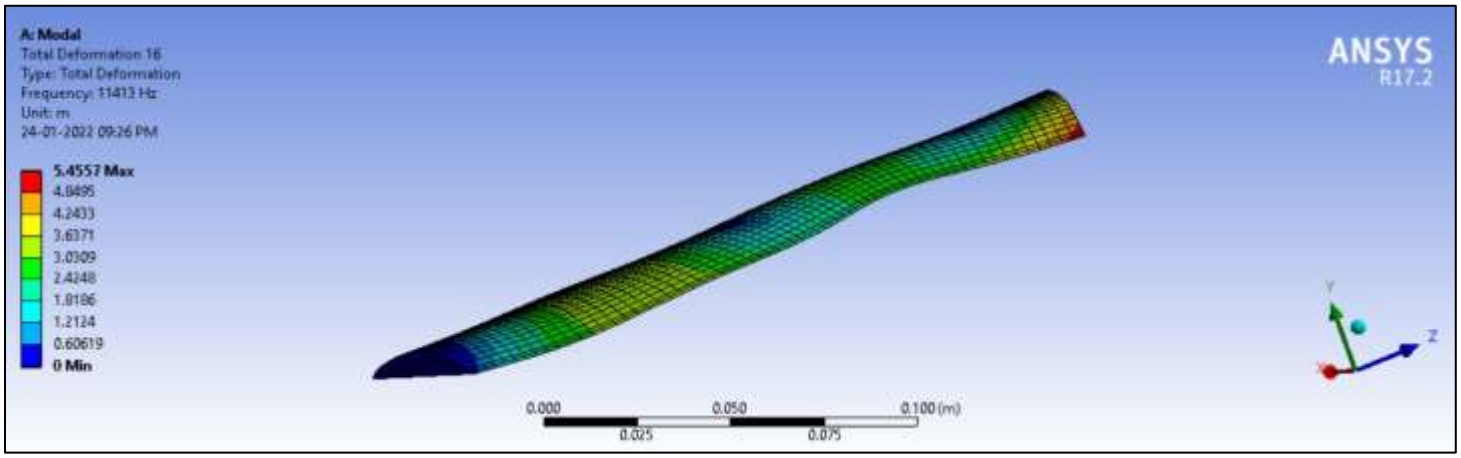

Mode	Frequency (Hz)
1	139.63
2	858.96
3	932.47
4	1042.3
5	2344
6	3098.5
7	4430.6
8	5289.8
9	6355.4
10	7000.3
11	7635.8
12	9851.7
13	10270
14	11413
15	12717

RESULT

In this paper, the UAV is designed and modelled first we designed in AutoCAD software and then imported to ANSYS. These are the following results obtained.

CONCLUSION

In this paper, the UAV is designed and modelled in AutoCAD software and then imported to Ansys, where the vibrational analysis was studied with modular analysis in ANSYS solver. The wing is considered as cantilever beam condition, and then the mode shapes are obtained. The 15 mode shapes of the wing are solved and results are obtained. The bending mode is observed, and are noted. Hence the deflection of the wing structure is studied under different modes and the flutter characteristics.

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