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DESIGN AND ANALYSIS OF FLEXVATOR

Abhilash A J[1], Prashanth Radhakrishnan[2], Prajwal C[3], Jhansi M J[4] & Sushmitha G[5]

[1]Research Scholar, Dautya Aerospace, Goa, India

[2]Director, Dautya Aerospace, Goa, India

[3,4,5]Research Scholar, Karavali Institute of Technology, Mangalore, India

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ABSTRACT

We proposed this topic because the economy and weight of the aircraft is the major challenge in the aviation industry. This idea of flexvator can reduce the weight of the aircraft and can increase aircraft efficiency, so keeping all these parameters in mind we are considering this to be major part of our project. If we consider the aircraft elevator we have many control surfaces, if we consider control surfaces there are a lot of parameters involved in the operation of the control surfaces.

As a solution for this, we are undergoing design and analysis on a new concept called flexvator. This idea of flexvator can be applicable to the wing rudder and elevators, for simplified study of this idea on the elevators of the aircraft. Which are used for the pitching movement of the airplane? By applying this concept on the elevators or wings, we will be getting reduced weight, increased speed, can and help us to carry more fuel long range cruise. The economy and weight of the aircraft is the major challenge in aviation industry. This idea of flexvator can reduce the weight of the aircraft and can increase aircraft efficiency, so keeping all these parameter in mind we are considering this to be major part of our project.

We are proposing this idea because in the present scenario the wings of aircraft carry heavy weight for control surface like flaps, and ailerons can help us to reduce the maximum percentage of weight on the wings. Elevators and rudder this idea of flexibility was introduced in the conceptual car of BMW. By taking that to implement it on consideration we are planned to implement it on aircraft wings to gain more efficiency, speed, and controllability by reducing additional loads like hinges, extra rods and balancing lead rods on the wings.

KEYWORDS: *Flexvator*

INTRODUCTION

The proposed idea of flexvator is though as a flexible elevator, during this design, the elevator on the horizontal stabiliser will give the vehicle dynamic performance. When the elevator deflects, the body of the wing will take over the action and so covered as if it were a versatile skin accommodating their various positions for this flexvator implemented aircraft elevator. Primarily used fabrics made from recycled or renewable materials and carbon fibre and also SMA wires, NITINOL.

NITINOL

Nickel-titanium is additionally called NITINOL, Nitinol55 and Nitinol 60 is few examples. Nitinol shape memory and "super elasticity" properties are the desirable unique property of this alloy.

Elevators

These are control surfaces, usually at the backside of an aircraft, which control the aircraft pitching movement, in order that the angle of attack and therefore the lift of the wing even be controlled. The elevators are usually hinged to the tailplane or control surface.

LITERATURE SURVEY

Longbin Liu[1] et al. In his way on "Study on influence of ambient temperature on biaxial stress and strength of flexible inflatable wing film" In his study, because the raise of the ambient temperature, the changes of the von Mises stress of the wing root, middle and wingtips of the complete airfoil are inconsistent, but the final warping deformation is improved, which provides a accurate reference for the structural and overall design and strength outcome of the flexible wing.

Hung Truong[2] et al. In his way on, "Influence of wing flexibility on the aerodynamic performance of a tethered flapping bumblebee", the existing structures of flapping insect wings make it challenging to study the role of wing flexibility in insect flight. In this concept, the mass spring arrangement is used to model wing structure as a thin, flexible membrane supported by network of veins to analyze the effect of wing flexibility, the Young's modulus should vary to make a comparison between two different wing models that we refer to as flexible and highly flexible.

Yang MENG[3] et al. In his way on, "Time-domain nonlinear aero elastic analysis and wind tunnel test of a flexible wing using strain-based beam formulation", here a strain-based beam model considered for nonlinear structural analysis is combined with the Unsteady Vortex Lattice Method form the complete framework for aero elastic analysis. In this theoretical study, the nonlinear boundary is considered by analyzing the desired response about the nonlinear static equilibrium with a sets of flow velocities. The outcome responses of the wing model at various observed frequencies are also studied.

Ilker Erdem[4] et al. In his way on, "Development of Automated Flexible Tooling as Enabler in Wing Box Assembly", Low Cost production and Assembly of Composite and Hybrid composite and non composite Structures project has dedicated a work package for the creation of an automated flexible tooling to meet the demands of future aerospace applications.

DONG Hegeng[5] et al. In his way on, "Numerical Research on Segmented Flexible Airfoils Considering Fluid-structure Interaction", this focuses on influence of flexible deformation on the lift and drag characteristics and aerodynamic load distribution on four segmented flexible airfoils at Reynolds number of 1.35×105. The observed results show that the divided flexible airfoils obtain a higher maximum lift coefficient, and effectively delay the stall point. At a higher angle of attacks, the deformation caused due to the flexibility of thin membrane could reduce the scale of the separation of vortexes in airplane. Meanwhile the small vortex generated between the flexible segments with the effect is called as "Fluid Roller Bearing" would forces the separated boundary layer to reattach to the airfoil surface especially on the first half chord region.

Possible Out Come

By implementing this idea on aircraft wings the weight of the aircraft can be reduced we can obtain more speed and efficiency, and also can study the wing characteristic by using analytical methods, the possible outcome will be more efficient according to studies, and can use this concept for long range operation aircrafts and also mainly in private jets Getting a instrumental stabilizer which can be used as elevator, no need of extra elevator Actuator hinges rods cables.

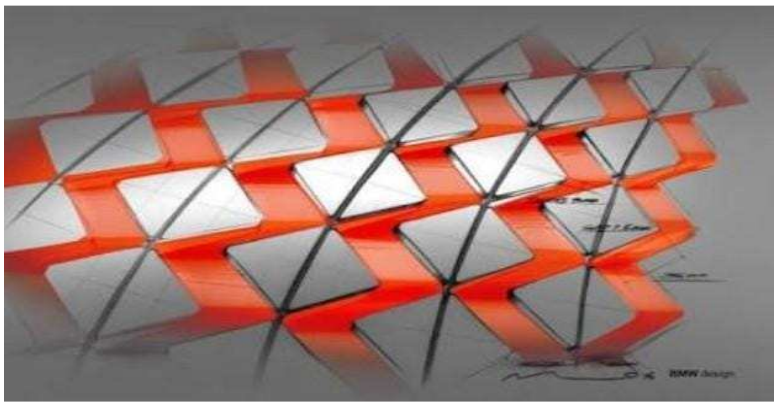

Figure 1: Resultant Surface.

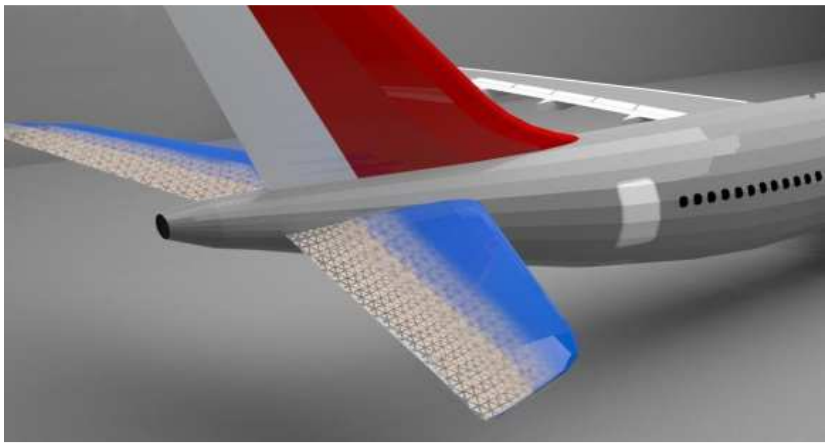

Figure 2: Final Design.

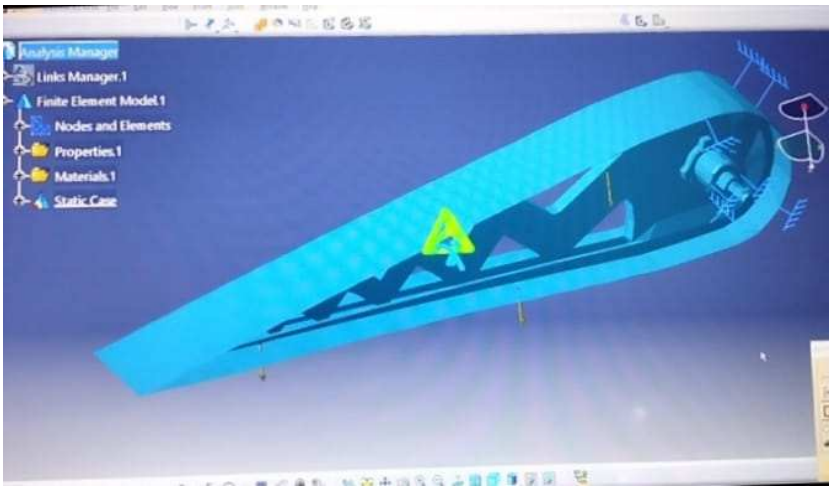

Figure 3: Cross Section.

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