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Design and Analysis of Naca0016 Wing Rib and Stringers by Using Al-7075 and Kevla

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ABSTRACT:

Wing structure consists of skin, ribs and spar sections. The spar carries flight loads and the weight of the wings while on the ground. Other structural and forming members such as ribs are attached to the spars, with stressed skin. The wings are the most important lift- producing part of the aircraft. The design of wings may vary according to the type of aircraft and its purpose. In this thesis, project detailed design of trainer aircraft wing structure made by using PRO-ENGINEER WILDFIRE 5.0. Then stress analysis of the wing structure is carried out to compute the stresses at wing structure. The stresses are estimated by using the finite element approach with the help of ANSYS to find out the safety factor of the structure. In a structure like airframe, a fatigue crack may appear at the location of high tensile stress. Life prediction requires a model for fatigue damage accumulation, constant amplitude S-N (stress life) data for various stress ratios and local stress history at the stress concentration. The response of the wing structure will be evaluated. In this thesis, the trainer aircraft wing structure with skin, spars and ribs is considered for the detailed analysis. The wing structure consists of 15 ribs and two spars with skin. Front spar having "I" section and rear spar having "C" section. Stress and fatigue analysis of the whole wing section is carried out to compute the stresses and life at spars and ribs due to the applied pressure load.

INTRODUCTION

A steady-wing craft is AN craft, like AN airplane. A collection wing craft is ready to flight exploitation wings through producing support due to the auto's forward air % and thus the form of the wings. Constant-wing craft region unit most likely exact from rotary-wing craft, inside which the wings form a rotor connected on a spinning shaft, within which the wings flap in the identical option to a bird. Aero plane steady-wing craft, moreover to looseflying gliders of

various kinds and specified kites, will use relocating air to realise top. Steam-powered consistent-wing craft profits ahead thrust from AN engine (aero planes) that embody steam-powered paragliders, steam-powered stoop gliders and a few raise autos. The wings of a suite-wing craft place unit are probably not inflexible.

Samples of constant wing craft location unit kites, seize-gliders, variable-sweep wing craft and aero planes exploitation wing-warping. Most constant-wing craft vicinity unit flown by way of utilizing a pilot on board the craft, but a number of the patterns vicinity unit controlled through an far away areas or by the use of pc programs.

2.LITERATURE REVIEW :

Design and Structural evaluation of the Ribs and Spars of Swept again Wing

The goal of this paper work is to design and analyze the ribs and spars of a hundred and fifty seater regional plane for the stresses and displacements as a result of the utilized hundreds. For this we did a comparative study on distinctive one hundred fifty seater regional aircraft. The foremost design parameters are suitably selected and then the mannequin was designed utilizing the CATIA application. The airfoil coordinates for the model to be designed, have been generated via design foil software. The predominant wing design parameters had been explained in element and the wing configuration has been described. Exclusive varieties of loads performing on the plane and the wing are determined and the moments, displacements, etc., are additionally decided. The wing constitution used to be also explained and functions of every element and their association are also studied. The methodology of finite detail approach and the certain description about more than a few FEM tools had been studied and implemented on this work.

Structural design of a UAV wing utilising finite aspect system

This paper offers the structural design methodology for the wing of an Unmanned Aerial auto. On this study, the appliance of computational approaches in design is successfully explored. The strength and stiffness evaluation of the UAV wing was once carried out making use of an FEA software ANSYS. The to be had CAD model and aerodynamic CFD evaluation of the vehicle were used as design input. The aerodynamic masses were utilized on the constitution as pressure features utilising a novel process using synthetic Neural

Networks. Results of variability in geometry, fabric and lay-up have been also analyzed to find the exceptional viable combo with top of the line force and stiffness amid minimum weight and rate. The eventually designed wing has two spars and used an all composite constitution. The wing is lighter in weight as compared to a an identical wing produced from Aluminum, and sufficiently strong adequate to meet all in-flight load stipulations and aspect of protection.

Design and analysis of Wing of an Ultralight plane

The paper offers with the structural design and analysis of high wing of an ultralight aircraft. The wing design entails its initial considerations like planform selection, area to the aircraft and the structural design includes the design calculations for the choice of airfoil, area of the wing, wing loading characteristics and weight of the wing. The design is finished akin to the calculated values with the aid of designing application CATIA and the evaluation is finished to show the structural deformations and stress for the applied loading stipulations with the aid of ANSYS 14.0, also the drag polar for the utilized go with the flow conditions is shown with the support of ANSYS FLUENT a drift evaluation software. The objective of this mission is to evaluate the outcome got for distinct materials like Al 2024- T3, Al 6061T6, Al 7075-T651 & Al 7075 + 15% FLY ASH MMC utilizing evaluation software. From the results we can conclude which material is having better residences.

Optimization of plane wing with composite material

The objective of this paper is to enhance an correct model for premier design via design the structure of wing that mix the composite (Skins) and isotropic substances (all other buildings) and evaluate this with the equal wing made by means of changing the orientation of composite ply orientation in dermis. The most appropriate design for each and every wing with exceptional ply orientation may also be received by way of comparing stress and displacement. Structural modeling is completed with the support of CATIA V5, each and every component modeled individually and assembled utilizing assembly workbench of CATIAV5, this meeting is then transformed to IGS file. Finite aspect modeling is accomplished in MSc Patran making use of the IGS file as geometry, the detail type used for meshing was once 2nd shell

elements with QUAD4 element topology and different parts are related making use of RBE2 connection. Static evaluation accomplished using MSc Nastran. The finite element mannequin bought is analyzed by using making use of an inertia force of 1g and then aerodynamic effect (carry) is used to simulate the wing loading on the wings. Optimal design is found by tabulating stress and displacement for each and every ply blend.

Design and Finite detail evaluation of aircraft Wing making use of Ribs

and Spars

A wing is a style of fin with a floor that produces aerodynamic force for flight or propulsion through the atmosphere, or by means of a different gaseous or liquid fluid. As such, wings have an airfoil shape, a streamlined move-sectional form producing elevate. A wing's aerodynamic exceptional is expressed as its elevate-to-drag ratio. The elevate a wing generates at a given velocity and angle of attack may also be one to 2 orders of magnitude bigger than the total drag on the wing. A excessive elevate-todrag ratio requires a enormously smaller thrust to propel the wings by way of the air at ample raise. The specifications for the plane wing are excessive stiffness, excessive strength, high toughness and Low weight.

Static & dynamic analysis of a natural plane wing constitution making use

of MSC Nastran

The paper is ready preliminary sizing and evaluation of a trainer aircraft wing. The principal function is to fix an appropriate structure inside the given envelope and to estimate the Gross take-off weight, wing loading, Stress distribution, low frequency vibrational modes, take-off distance and stall velocity. Sizing is finished through making use of classical engineering theories and FEA applications. Skin and internet are considered as shell elements. Flange, spar and stringer are considered as beam elements. From the evaluation structure has been optimally designed which satisfies the strength and stability standards. The detailed design of trainer aircraft wing constitution is modelled utilising CATIA V5 R20. Then stress evaluation of the wing constitution is implemented by means of utilising the finite detail approach with the help of MSC NASTRAN/PATRAN to discover the protection aspect of the constitution.

CONCLUSION

In this thesis, the trainer aircraft wing structure with skin, spars and ribs is considered for the detailed analysis. The wing structure consists of 15 ribs and two spars with skin. Front spar having „I" section and rear spar having „C" section. Stress and fatigue analysis of the whole wing section is carried out to compute the stresses and life at spars and ribs due to the applied pressure load.

By observing the static analysis of aircraft wing, the stress values are increases by increasing the speed (400,600 & 800 km/hr) of the air craft wing, the less stress value for carbon epoxy than s2-glass and aluminum alloy 6061-T8. Carbon epoxy material has more strength because it is a composite material.

By observing the modal analysis of aircraft wing, the deformation and frequency values are more for carbon epoxy material. By observing the fatigue analysis of aircraft wing, the safety factor value is more for carbon epoxy material.

So it can be conclude, the carbon epoxy material is better material for aircraft wing

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