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MODELING AND ANALYSIS ON WING OF A380 FLIGHT

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ABSTRACT

The A380 is currently the largest aircraft in commercial operation and one of the most advance planes in the world. The Airbus A380 is a double deck, wide body four-engine jet airliner manufactured by the European corporation airbus, a subsidiary of Eads. This common design approach sacrifices some Fuel Efficiency (due to a weight penalty) on the A380-800 passenger model, but Airbus estimates that the size of the aircraft, coupled with the advances in technology described below, will provide lower operating costs per passenger than the 747-400 and older 747 variants. In recent years we found minor cracks on wings of A380. Some of them were related to production. The minor cracks - no more than two centimeters long - were discovered on some of the wing rib brackets and were caused by a manufacturing issue and not the turbulence. But inspections found that were related to rib feet .originally the cracks are in brackets in the middle of the giant wings. In this project an attempt is made in to find the reason for cracks on the wings. Firstly we made modeling of the entire flight. We modeled wing separately. Later we made steady state thermal analysis and transient thermal analysis on the wing.

1. INTRODUCTION

The Airbus A380 is a double deck, wide body, four-engine jet air liner manufactured by the European corporation Airbus and a subsidiary of EADS. It is the world's largest passenger airliner. The A380 was initially offered in two models. The A380-800 original configuration carried 555 passengers in a three class configuration or 853 passengers (538 on the main deck and 315 on the upper deck) in a single-class economy configuration. In May 2007 Airbus began marketing a configuration with 30 fewer passengers, (525 total in three classes), traded for 370 km (200 nmi) more range, to better reflect trends in premium class accommodation.

2. Advanced materials:

While most of the fuselage is aluminum, composite materials comprise more than 20% of the A380's airframe. Carbon-fiber reinforced plastic, glass-fiber reinforced plastic and quartz-fiber reinforced plastic are used extensively in wings, fuselage sections (such as the undercarriage and rear end of fuselage), tail surfaces, and doors. Newer weld able aluminum alloys are also used. This enables the widespread use of laser beam welding manufacturing techniques, eliminating rows of rivets and resulting in a lighter, stronger structure.

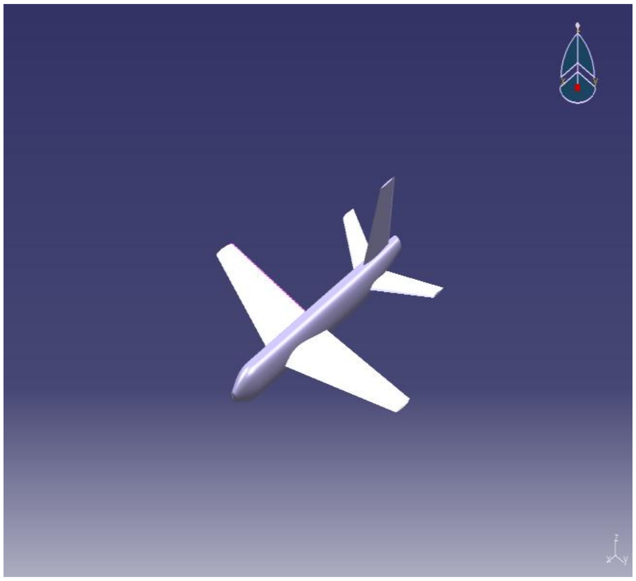

Fig 1. Conceptual design of A380

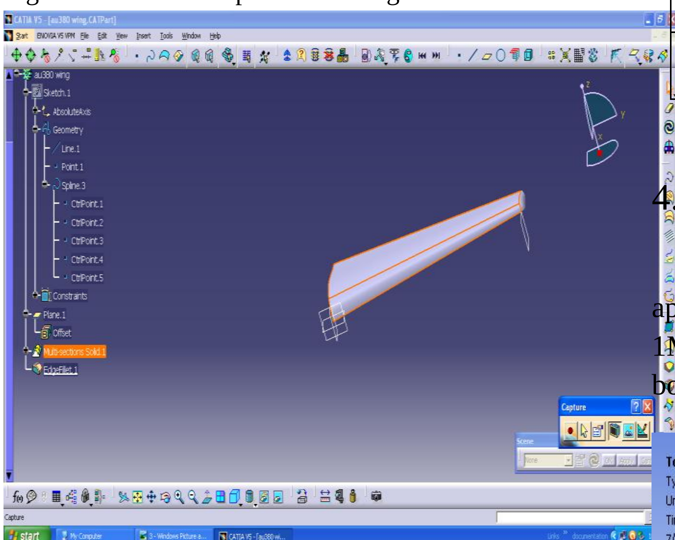

Fig. 2 Conceptual design of wing

3. PROBLEM DEFINITION:

Now day's cracks were found on the wings of a380. In this project we made an attempt to find the reason behind the cracks from design prospective. We made all the analysis using ANSYS WORKBENCH. We applied varying pressure between 1Mpa and 1.5Mpa with in temperature 22°C to 35°C. We used aluminum alloy as material. Modeling of Flight and wing was done in CATIA V5 R18. Dimensions of the flight

Wing span: 79.75 m

Overall length72.72 m

Height24.09 m

Table 1. Input Values

MATERIAL	Aluminum Alloy
VOLUME	793.55 m^3
MASS	2.1981e6kg
No. OF NODES	1381
No. OF ELEMENTS	595
DENSITY	2770. kg/m^3
SPECIFIC HEAT	875J/Kg °C

4. TOTAL DEFORMATION:

In the fig 3. We fixed one end and we applied uniform temperature and we have pressure 1Mpa at top and front end of the wing, 1.5Mpa at bottom of the wing.

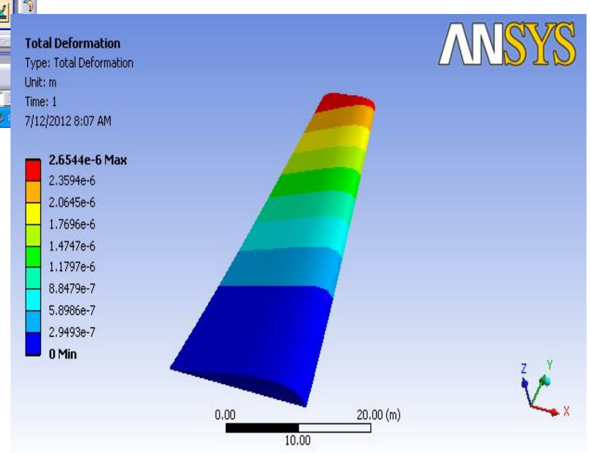

Fig 3. Total deformation

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5. EQUIVALENT STRESS:

In the fig 4. We fixed one end and we applied uniform temperature and we have pressure 1Mpa at top and front end of the wing, 1.5Mpa at bottom of the wing.

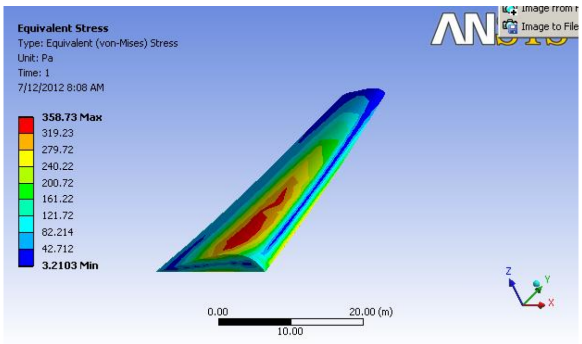


Fig 4. Equivalent Stress

6. MAXIMUM PRINCIPAL STRESS:

In the fig 5. We fixed one end and we applied uniform temperature and we have pressure 1Mpa at top and front end of the wing, 1.5Mpa at bottom of the wing.

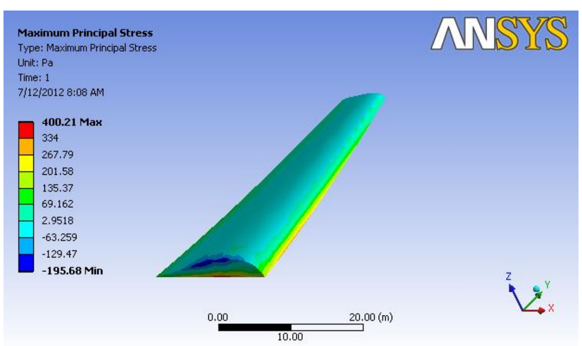


Fig 5. Max. Principal Stress

7. MINIMUM PRINCIPAL STRESS:

In the fig 6. We fixed one end and we applied uniform temperature and we have pressure 1Mpa at top and front end of the wing, 1.5Mpa at bottom of the wing.

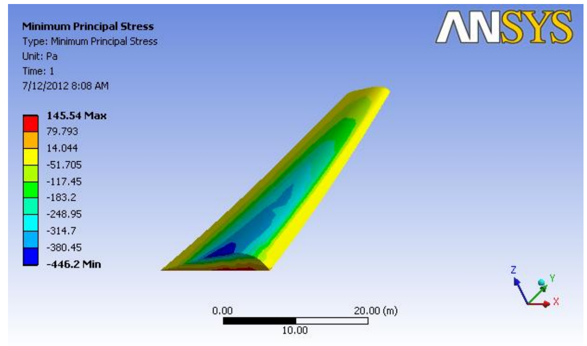


Fig 6 Min. Principal Stress

8. DIRECTIONAL HEAT FLUX:

In the fig 7. We fixed one end and we applied uniform temperature and we have pressure 1Mpa at top and front end of the wing, 1.5Mpa at bottom of the wing.

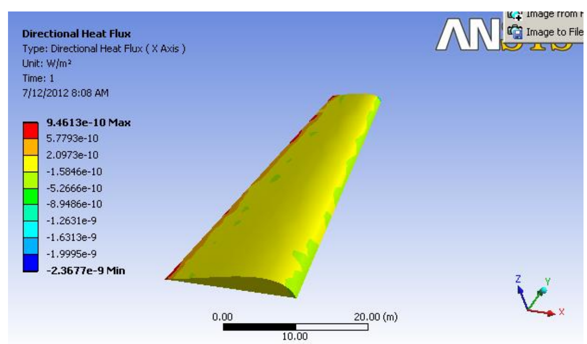


Fig 7 Directional Heat Flux

9. TRANSIENT THERMAL ANALYSIS:

Table 2. Input Values

MATERIAL	Aluminum Alloy
VOLUME	793.55 m³
MASS	2.1981e6kg
No. OF NODES	1381
No. OF ELEMENTS	595
DENSITY	2770. kg/m³
SPECIFIC HEAT	875J/Kg °C
TEMPERATURE BETWEEN	22 TO 35°C

10. TOTAL HEAT FLUX:

In the Fig 8. We have given varying temperature between 35°C to 28°C. with pressure 1Mpa at the front end of the wing.

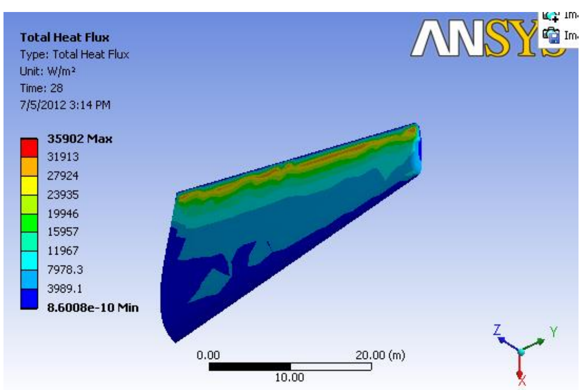


Fig 8 Total Heat Flux

11. DIRECTIONAL HEAT FLUX:

In the Fig 9. We have given varying temperature between 35°C to 28°C. with pressure 1Mpa at the front end of the wing

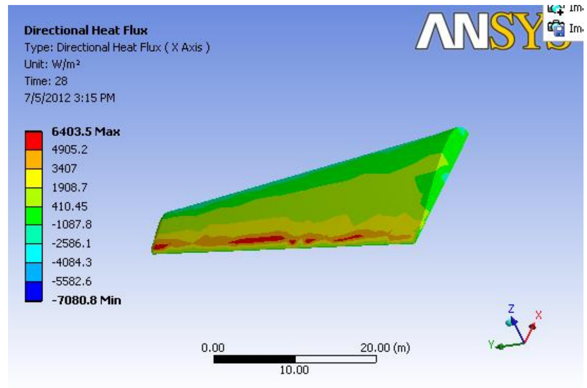
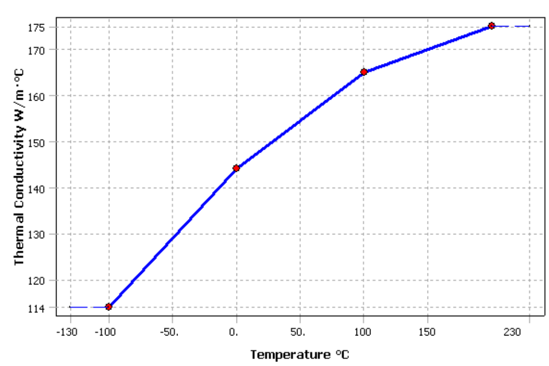


Fig 9 Directional Heat Flux

Structural	
Young's Modulus	7.1e+010 Pa
Poisson's Ratio	0.33
Density	2770. kg/m³
Thermal Expansion	2.3e-005 1/°C
Thermal	
Specific Heat	875. J/kg·°C

Fig. 10 Aluminum Alloy > Thermal Conductivity



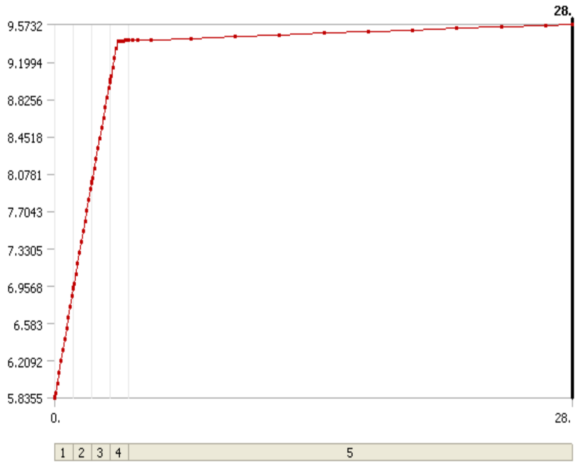


Fig. 11 Temperature - Global Minimum

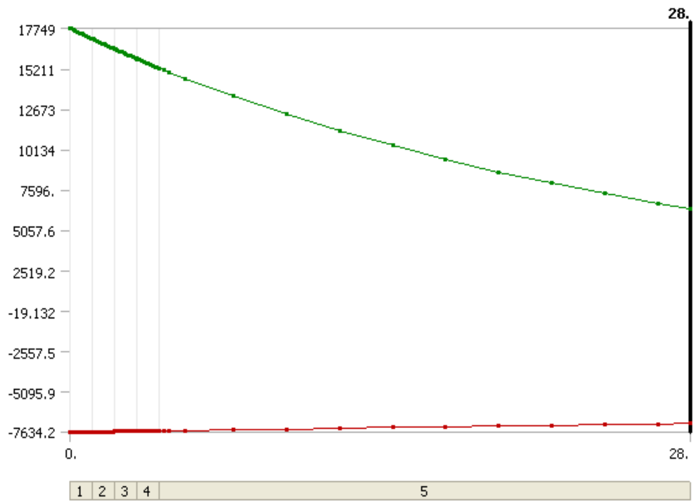


Fig. 12 Directional Heat Flux

11. CONCLUSION:

Under the above conditions we got stress and strain values with in the limiting range. The maximum stresses that wing of a flight can with stand are 700pa. but we got stress 400pa So the wing we have designed is safe.

12. References:

http://en.wikipedia.org/wiki/Airbus_A380

and other websites of a380 and database of other fight designs.