

Airframe Design and Construction

Fuselage Structure Design

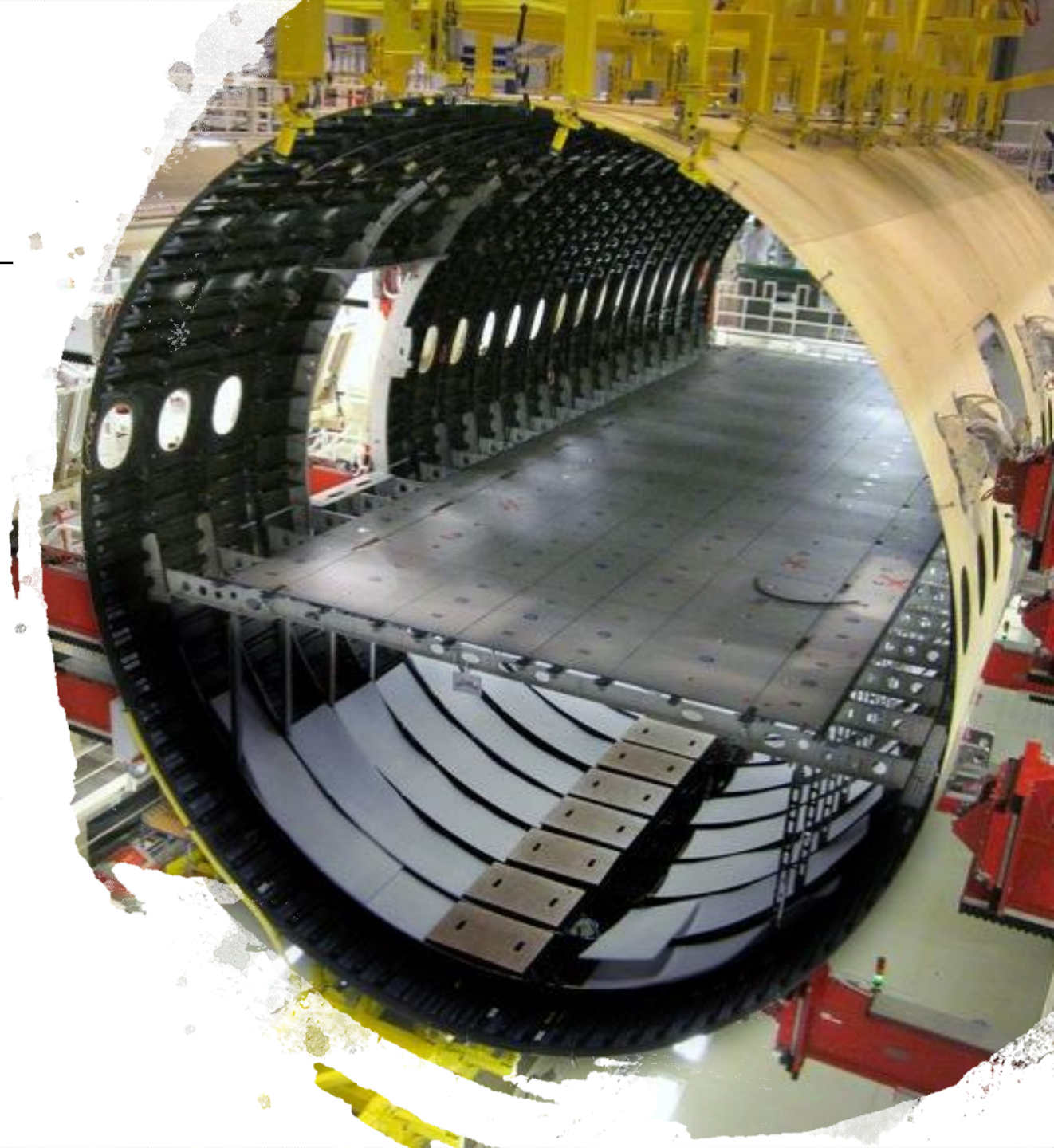
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Fuselage Structural Design

- In the analysis problem the fuselage structure arrangement is given and it is required to check for failure, stresses, and/or ultimate strength.
- In the design problem, the fuselage structure is not given, and it is required to create it based on certain design requirements.



Fuselage structure design

Solution strategy

- First, the designer should decide the type of material suitable for his design; whether he will use metallic material or composite materials.
- Second, assume an initial structure shape for the fuselage based on previous experience, design constraints from aerodynamics, and similar problems.
- Then, solve this design to determine the stresses result from the applied loads, and the margin of safety.
- Check the stresses and calculate the margin of safety.
- Finally, If the margin of safety is acceptable accept this design to be the final design. If the margin of safety not accepted (i.e. relatively high or low), change the fuselage structure variables (design variables) to improve your design.

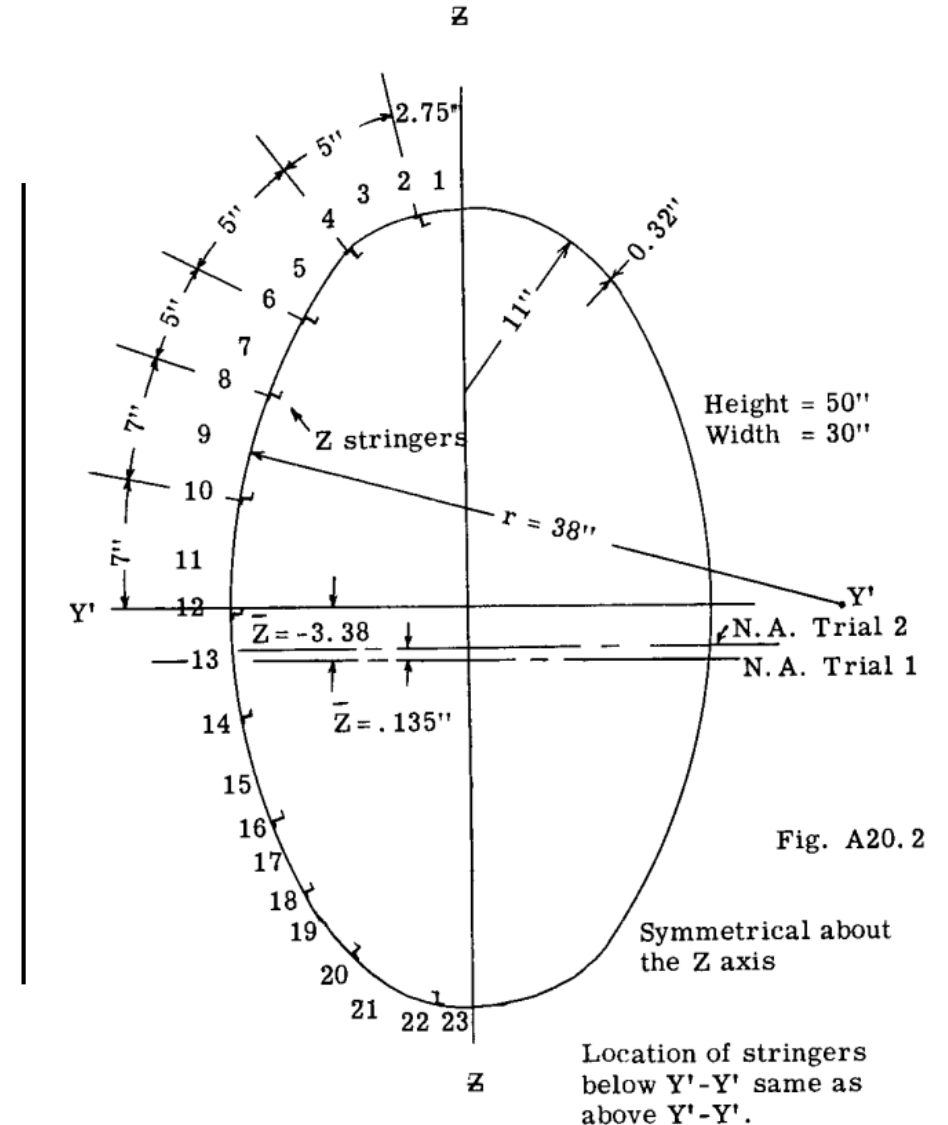
Fuselage structure design project

It is required to determine the fuselage structural design for a design bending moment of 10^9 Ib.in.?

Fuselage structure design project

Requirements

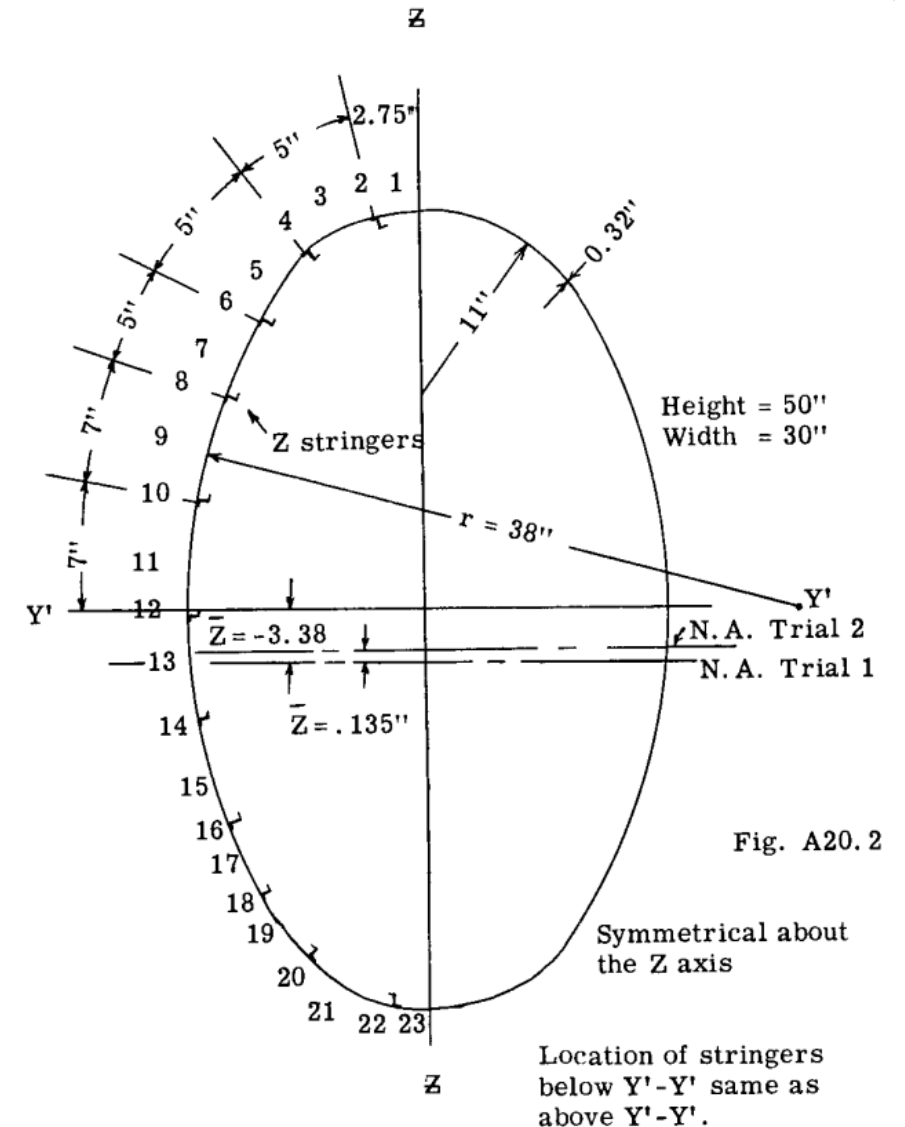
- Select a suitable shape for the fuselage based on the design requirements.
- Assume the fuselage is made from Aluminum.
- The fuselage should contain two cells separated by a floor.
- It should contain taper.
- The fuselage length is 200 in and upper cell height is 70 in while the lower cell height should be 40 in.
- Consider the cut for airplane door and undercarriage.
- Calculate the fuselage stresses, and shear flow to ensure that it is safe.
- Calculate the ultimate bending moment M_y .



Fuselage structure design project

Deliverables

1. Excel sheet contains the mentioned sheet problems in addition to the design problem with
 - clear problem statement
 - requirements
 - organized solutions
2. Report for the design project including
 - Cover page
 - Problem statement
 - design procedure
 - summary of the final design including figures and your comments
3. Final presentation (oral exam)

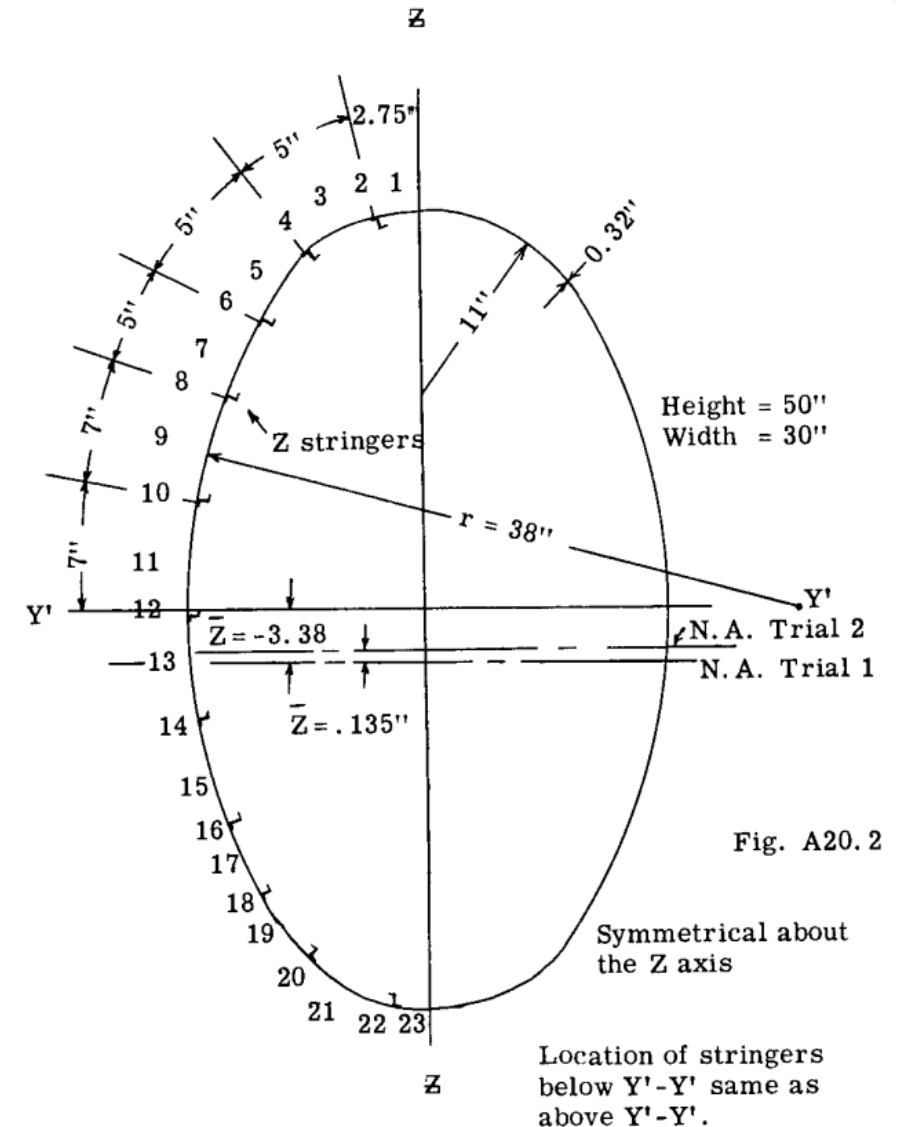


Fuselage structure design project

Team management and Deadline

- Every team have maximum of two members.
- The presentation should not exceed 5 minutes for describing
 - The design procedure
 - The contribution of each team member
 - Summary of the final results including plots
 - Model validation
- The project deadline and presentations on Sunday 5/5/2019 at the class room.

Best projects will be selected and have bonus marks.



In addition to the sheet problems

Problem 4 in sheet 2

In addition to all problems of sheet 3

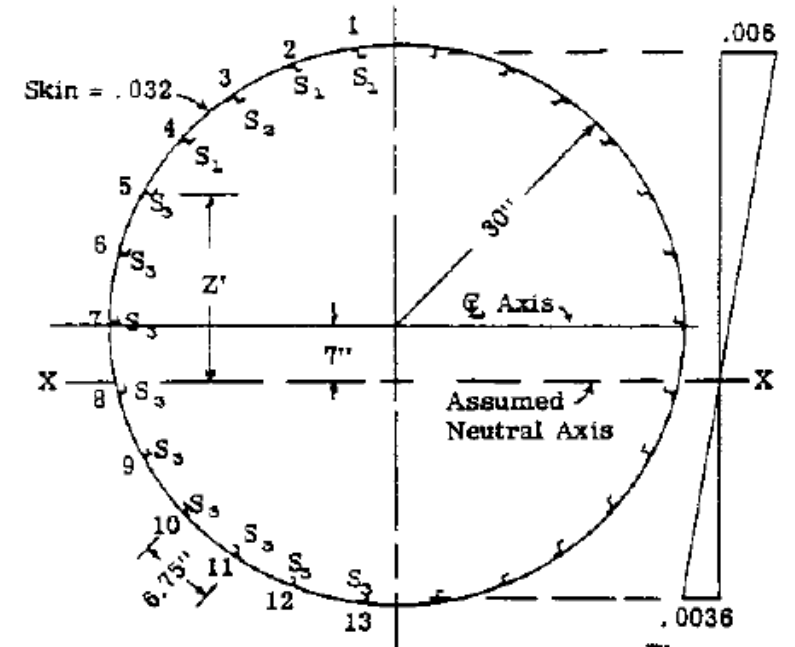


Fig. a
Strain
Diagram

