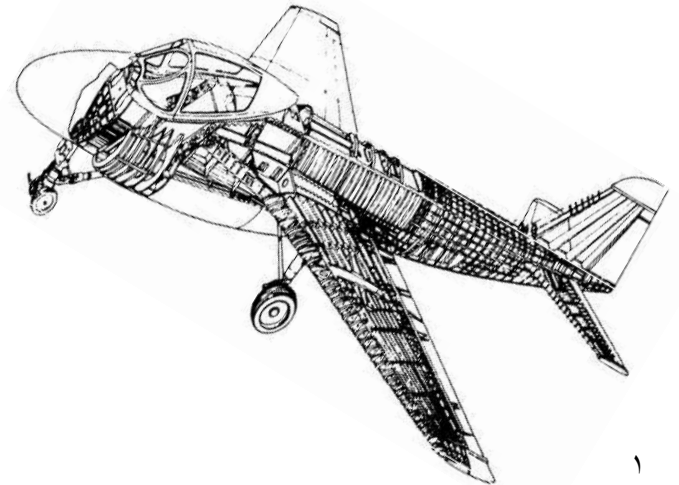


Aircraft Structural Analysis

by

Dr. Hanafy Omar

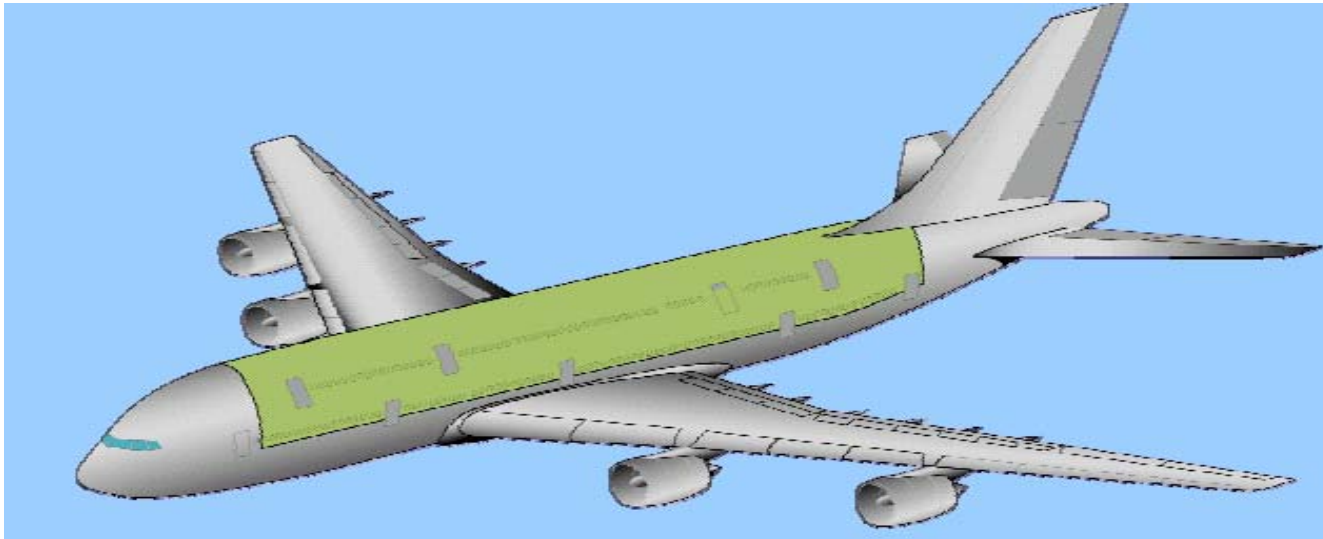
*Aerospace Engineering Department
KFUPM*



Function of the Aircraft Structure

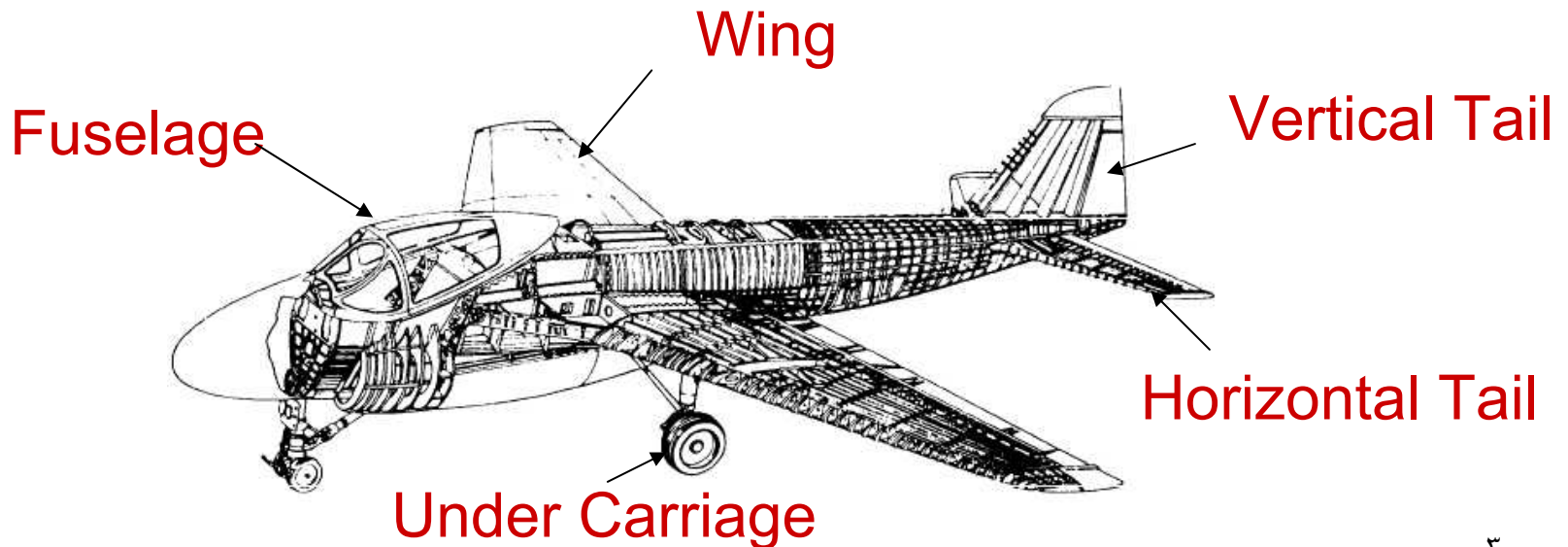
The basic functions of an aircraft's structure are to

- Resist the applied loads
- Provide the aerodynamic shape
- Protect passengers, payload, systems, etc from the environmental conditions encountered in the flight



Aircraft Structure Components

1. Wing
2. Fuselage
3. Empennage (Vertical and Horizontal Tail)
4. Under Carriage (Landing Gear)
5. Engine Mounts

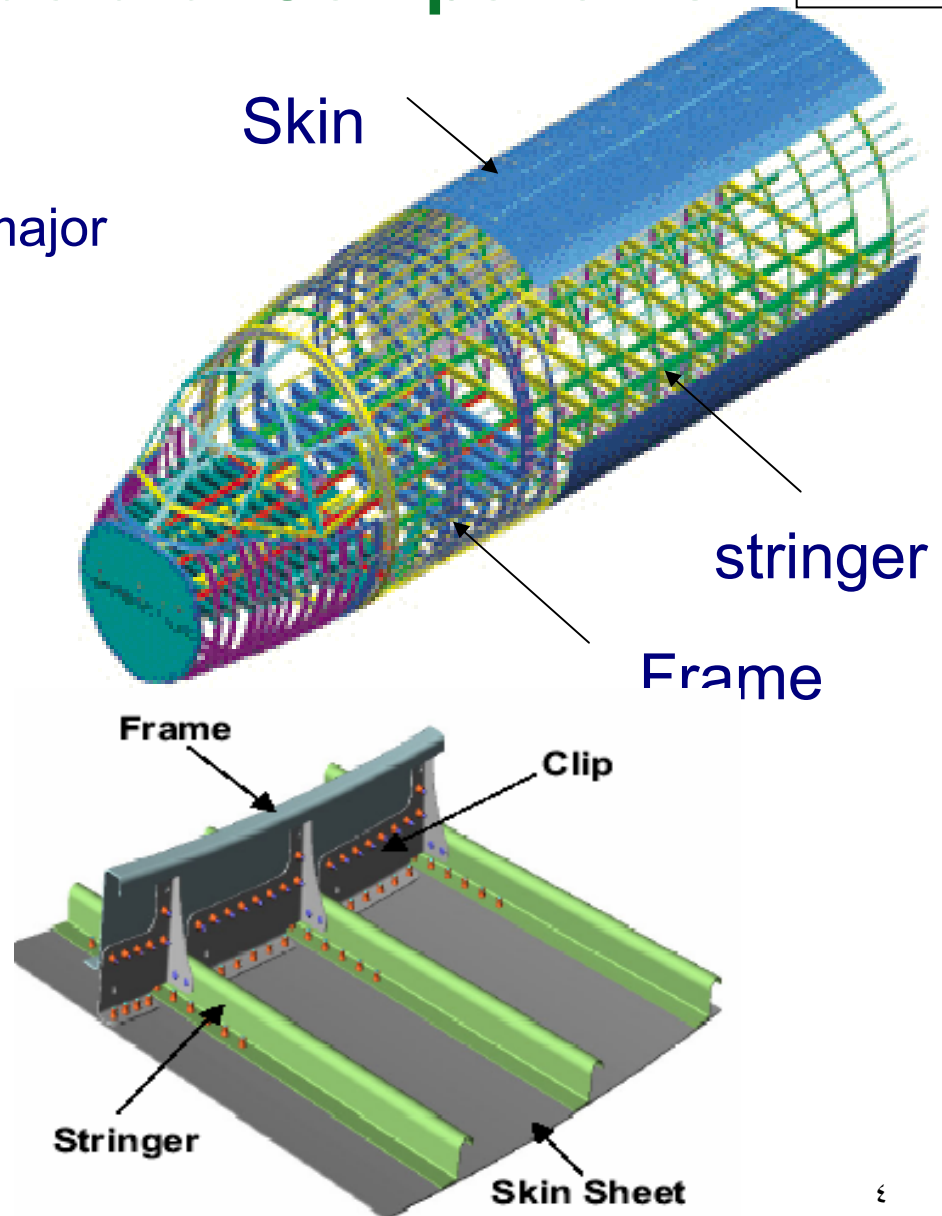
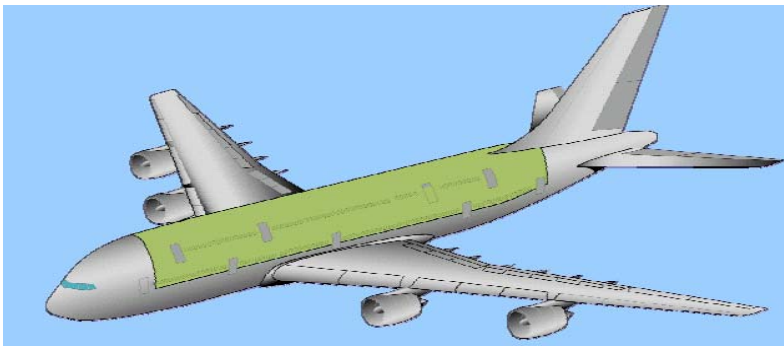


Internal Aircraft Structural Components

Fuselage

For the conventional fuselage, the major structural elements are:

- Transverse Frame
- Longitudinal Stringers
- Longerons (primary stringers)
- Skin

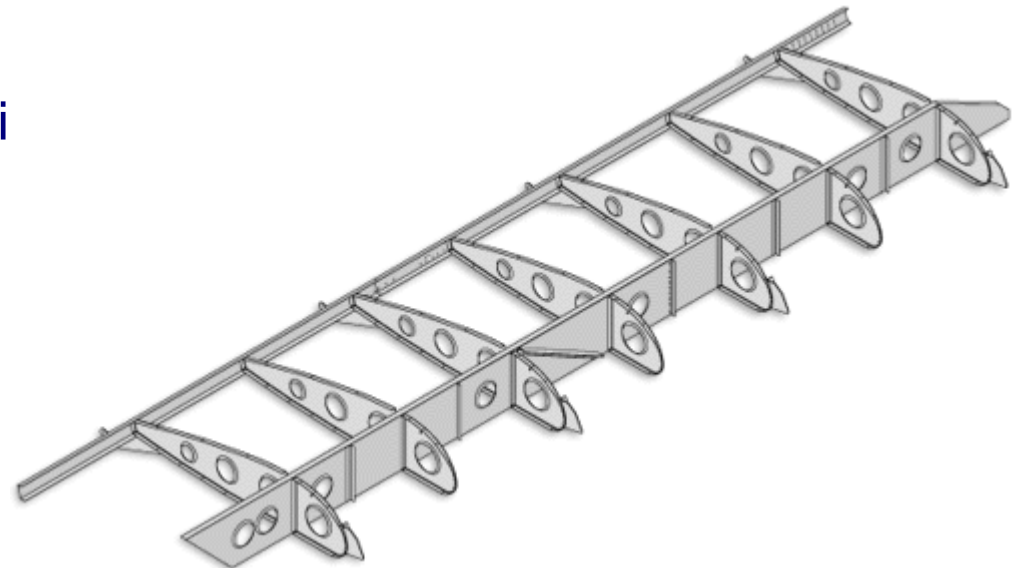
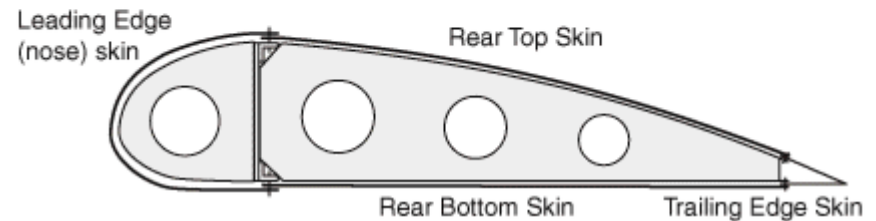
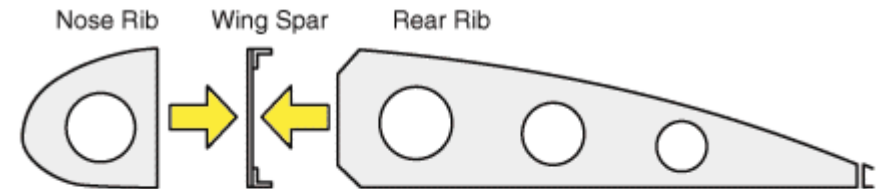


Internal Aircraft Structural Components

Wing

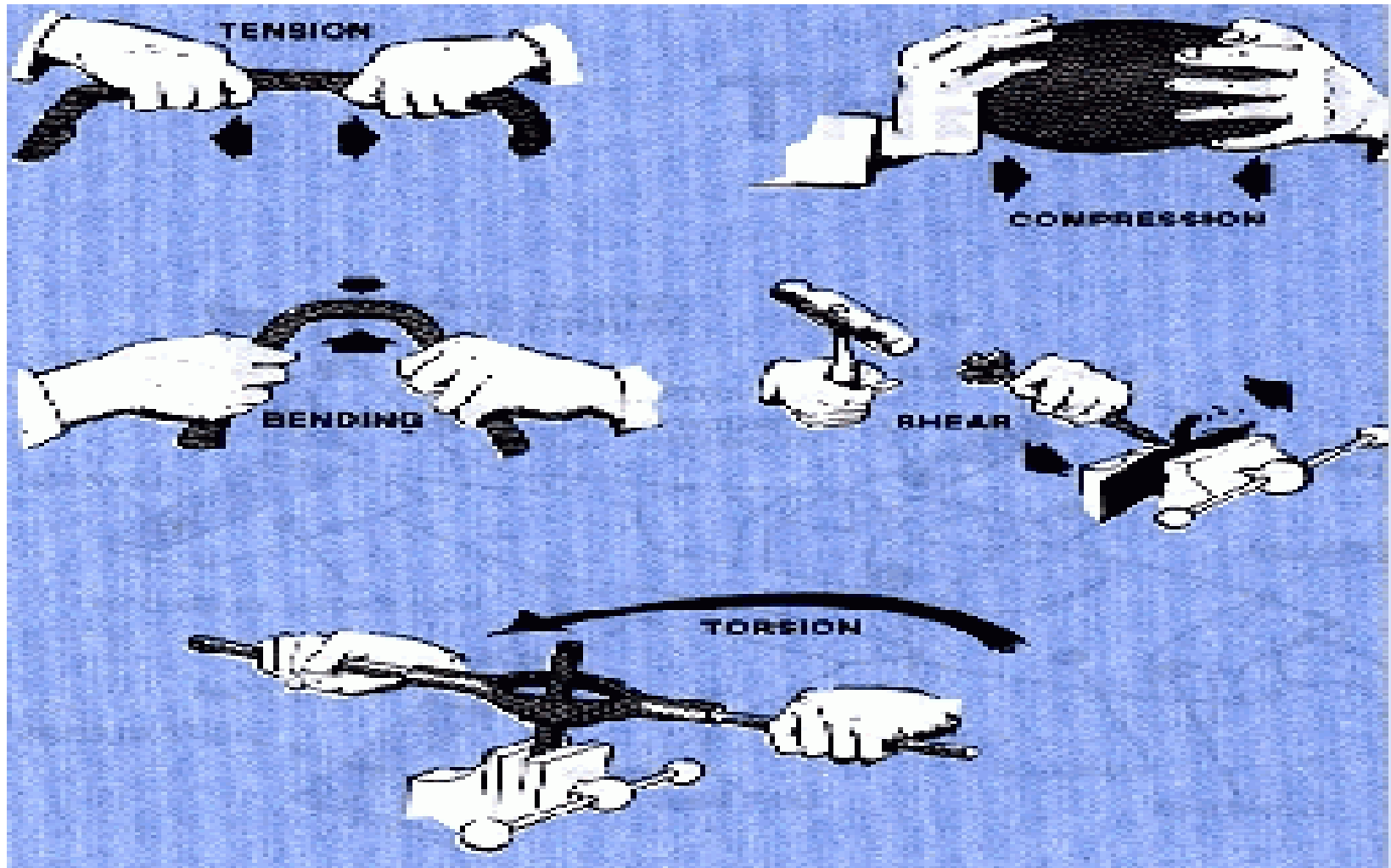
For the conventional wing, the major structural elements are:

- Spars (transmitting most of the bending load arising from the aircraft weight)
- Ribs (defines the aerodynamic shape of the wing)
- Skin

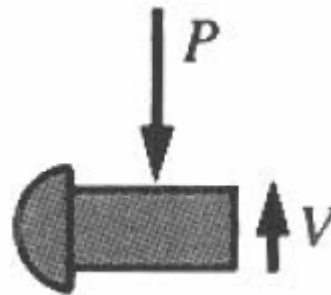
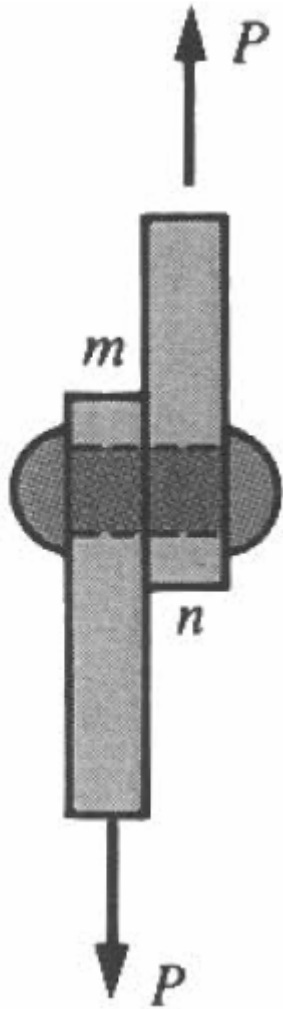


Empennage has the same structure as Wing

Stress

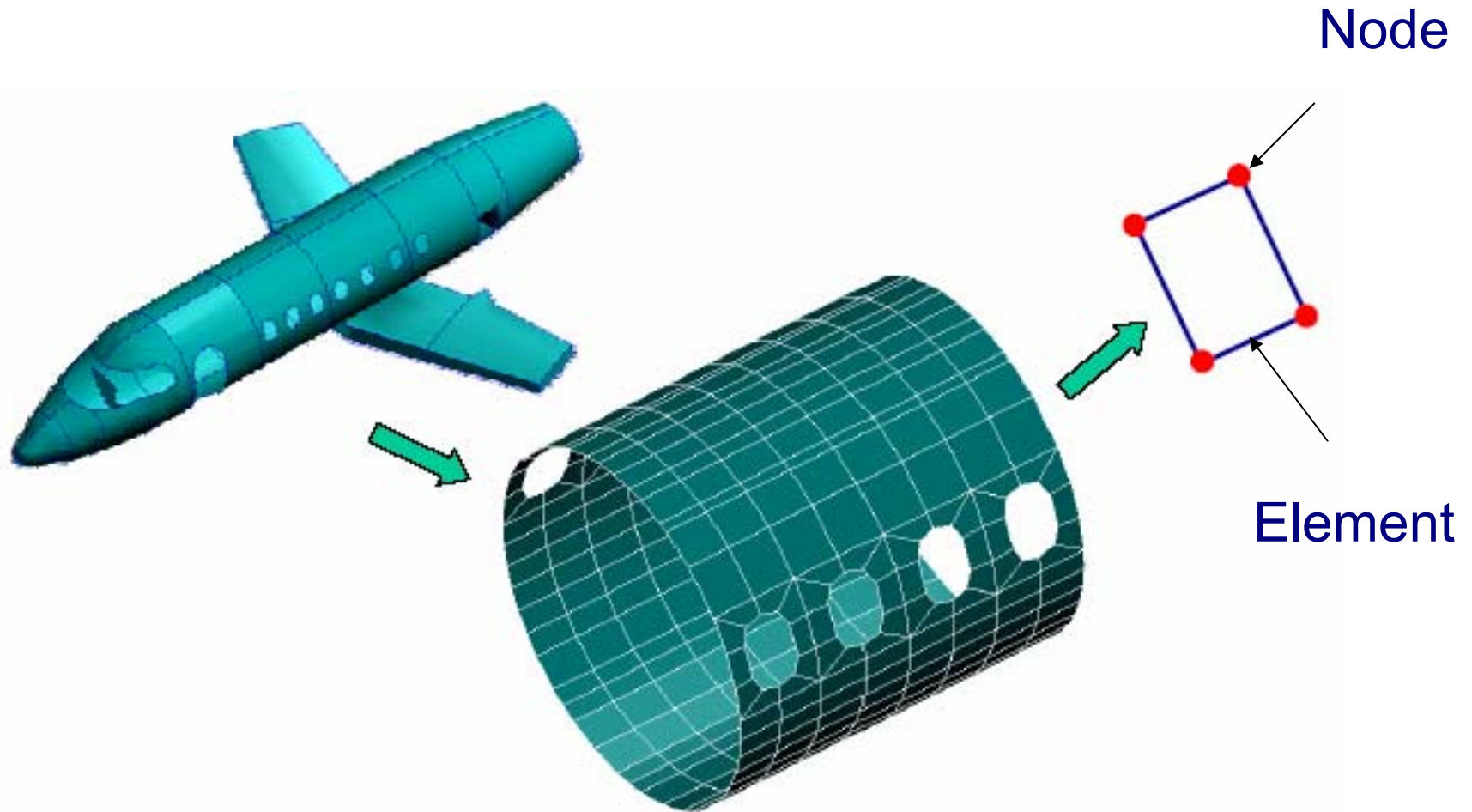


Shear Stress



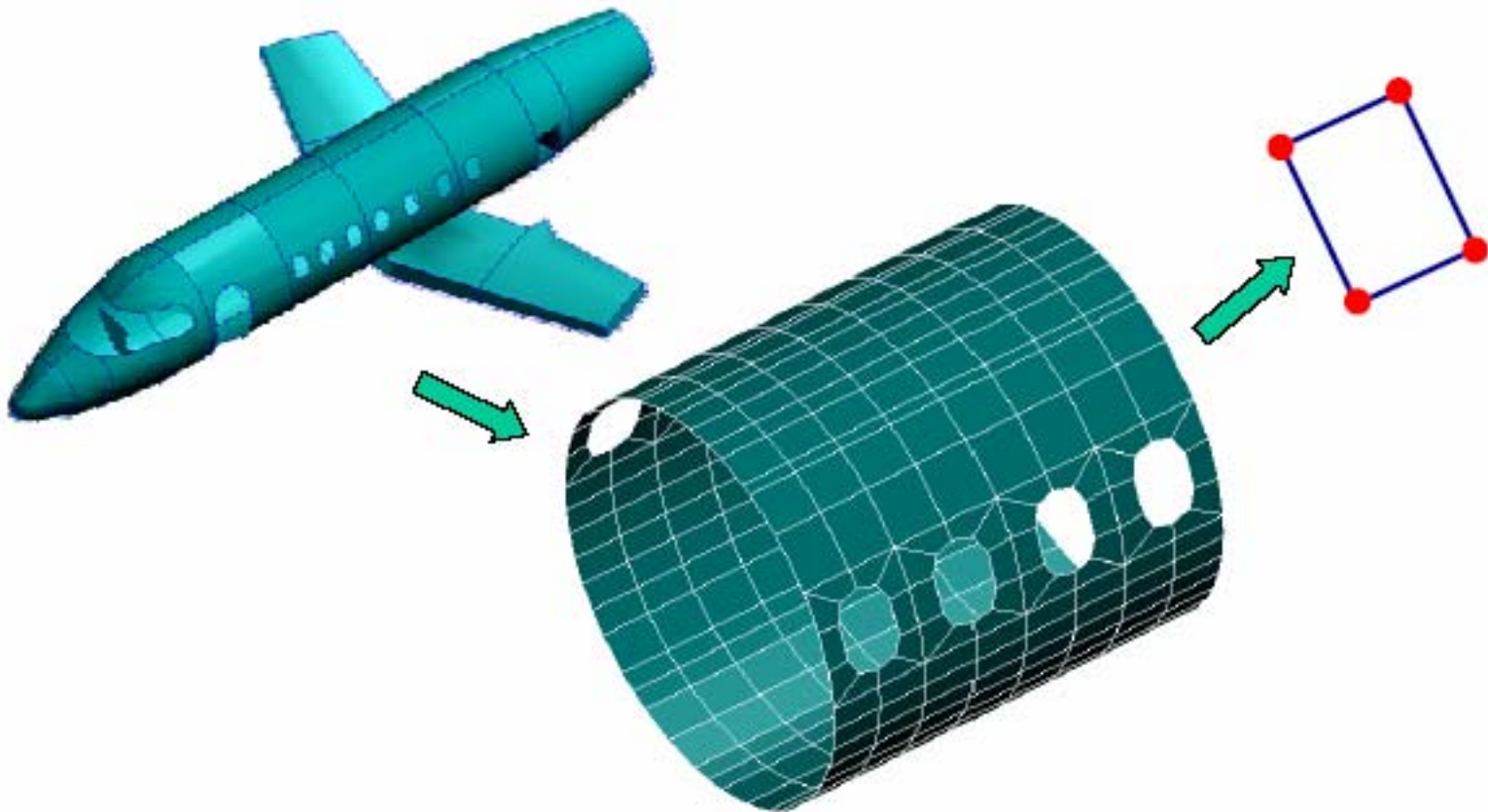
$$\tau_{ave} = \frac{V}{A} = \frac{P}{A}$$

Finite Element Analysis

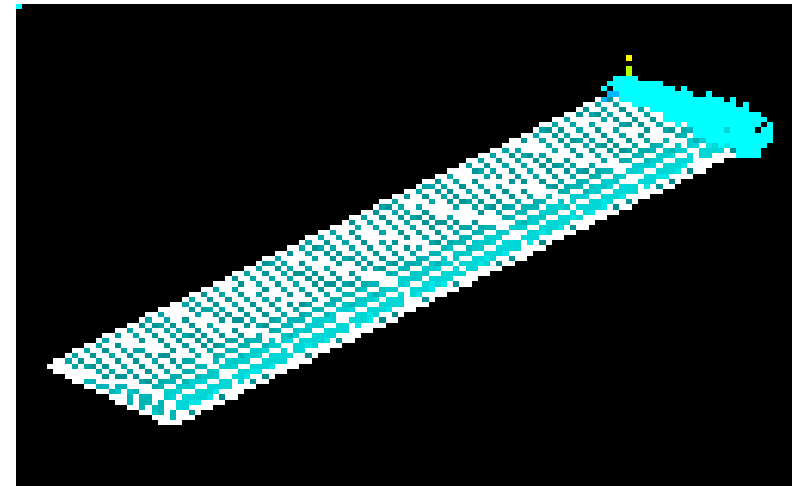
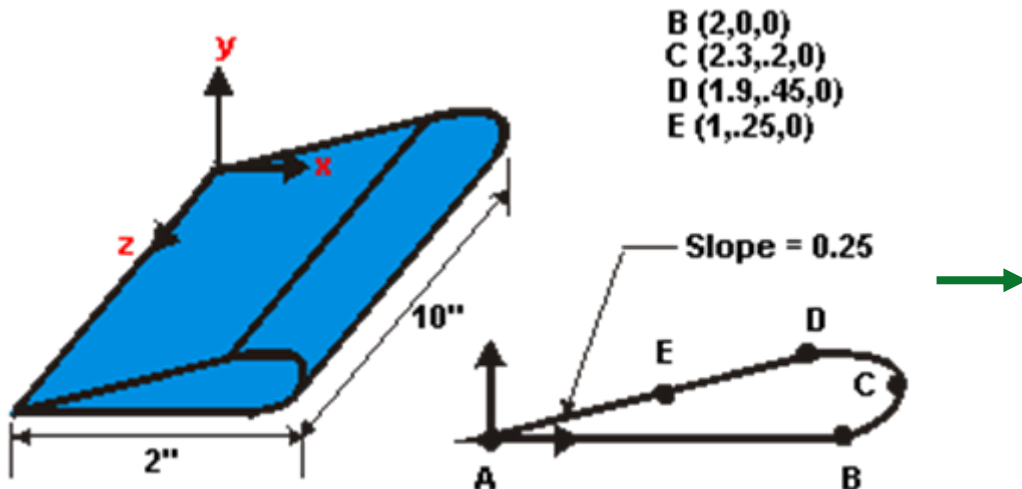


Two Dimensional Elements

2D plate elements are used to model thin structural members such as aircraft fuselage skin



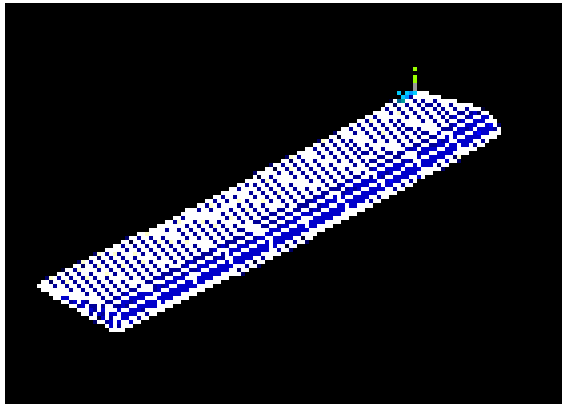
Aircraft Wing Modal Analysis Using Ansys



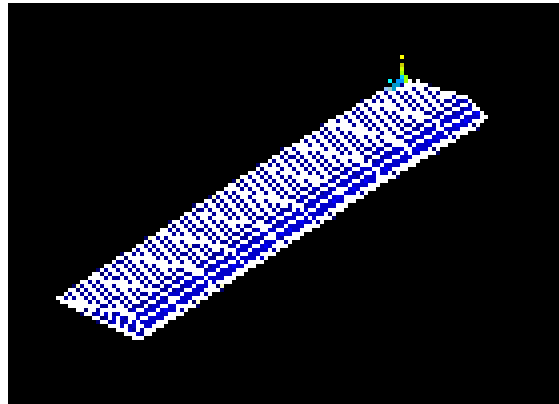
Ansys Model

Aircraft Wing Modal Analysis using Ansys

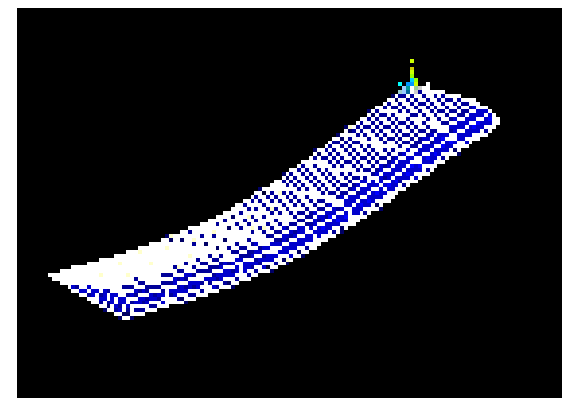
First Mode



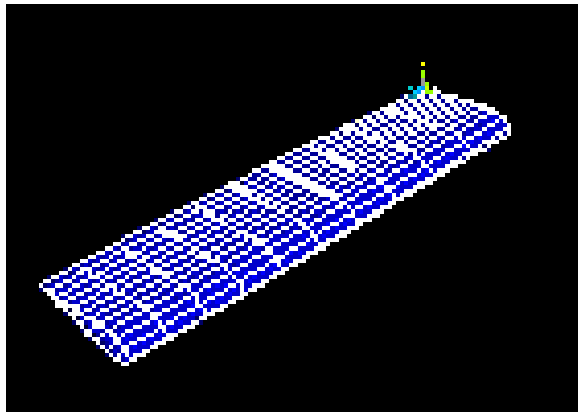
Second Mode



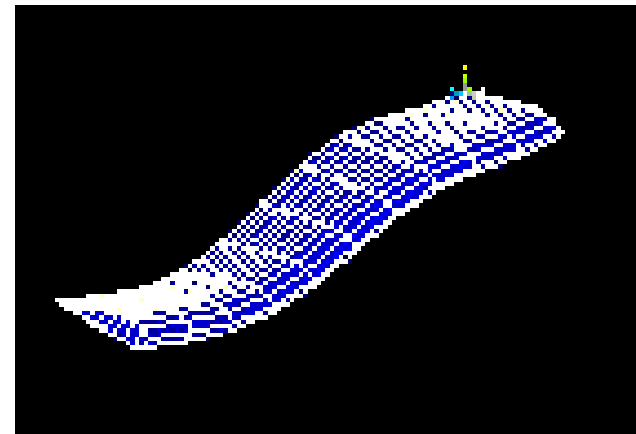
Third Mode



Fourth Mode



Fifth Mode



Questions

