Load Sources:

- Aerodynamic / inertia loads
- Manoevers and gusts
- Emergency landing inertias
- Cabin pressurisation loads
  ↳ fatigue loading
- Landing loads
  ↳ high loading + fatigue loading
- Engine loads
  ↳ thrust, weight, torque and gyroscopic effects
- Thermally induced loads
  ↳ differential thermal expansion
- Impact / crash loads

Types of Load:

Tension - tie bars and cables effective carriers
↳ one strand fracture ≠ equal failure

→ main issues for tension loaded structures are fracture & fatigue.

Compression - thin walled tube as 2nd MoA maximised for given amount of material

→ critical due to buckling: depends on I_x and E
fatigue less of concern as cracks don't propagate under compression

Shear - carried by tensile & compressive members at 45°
Panels also good at carrying shear by resisting shape change

Bending - I beam effective to resist bending due to ↑ I_x

Bending with shear

Torsion - twisting moment : carried effectively by shear forces around closed structure - a box / tube with continuous skin is best alternatively crossed brace members

Types of Airframe Construction :

- Frame with non-structural covering
  → all loads carried by frame structure
  → skin assumed not to carry any load except air pressure
  → used for early aircraft with low loads

- Monocoque
  → single skin with no supporting frame
  → all loads carried by skin
  → poor for large size due to buckling

- Stressed Skin

Stringer - stiffening element

Frame

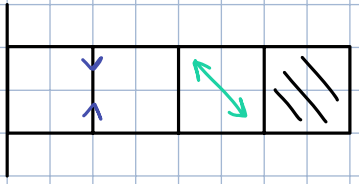
} Ribs - divide skin into small panels to resist buckling

→ load divided between skin & stringers

- Shear Resistant Structures

→ Panels carry shear without buckling
→ Stiffners divide panels up to avoid buckling

- Tension Field Structures



Compression carried by stiffners

Diagonal tension carried by panels

Functions of Structural Members: