

C103
S, S10
C102 G

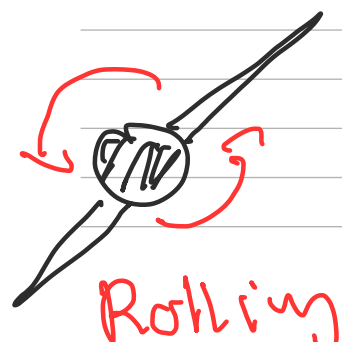
C1041. Flight Stability and Dynamic

See the picture from the Book
page 4.2.

1. longitudinal axis (Rolling) - controlled by Aileron
(Aileron) - lateral control
2. Lateral Axis - (pitching) - controlled by elevator
(Elevator) - longitudinal control
3. Vertical Axis (Yawing) - controlled by Rudder
(Rudder) - directional control.

Three primary controls

1. Ailerons - Rolling
2. Elevator - pitching
3. Rudder - yawing



1. Stability :: $\begin{matrix} \swarrow & \searrow \\ \text{static} & \text{dynamic} \end{matrix}$

Ability of Aircraft to maintain straight and level flight without pilots

2. Controllability ::

Generation of Aerodynamic force to guide the aircraft on a desired path.

3. Manoeuvrability ::

Ability to follow a path with forcing stress of manoeuvring.

Stability



Static :: give only one force

positive

القدرة قروح وقرى كذا

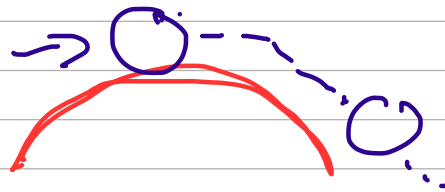


Neutral



given F $\swarrow$ more here

Negative



بترجى قروح قري يهك

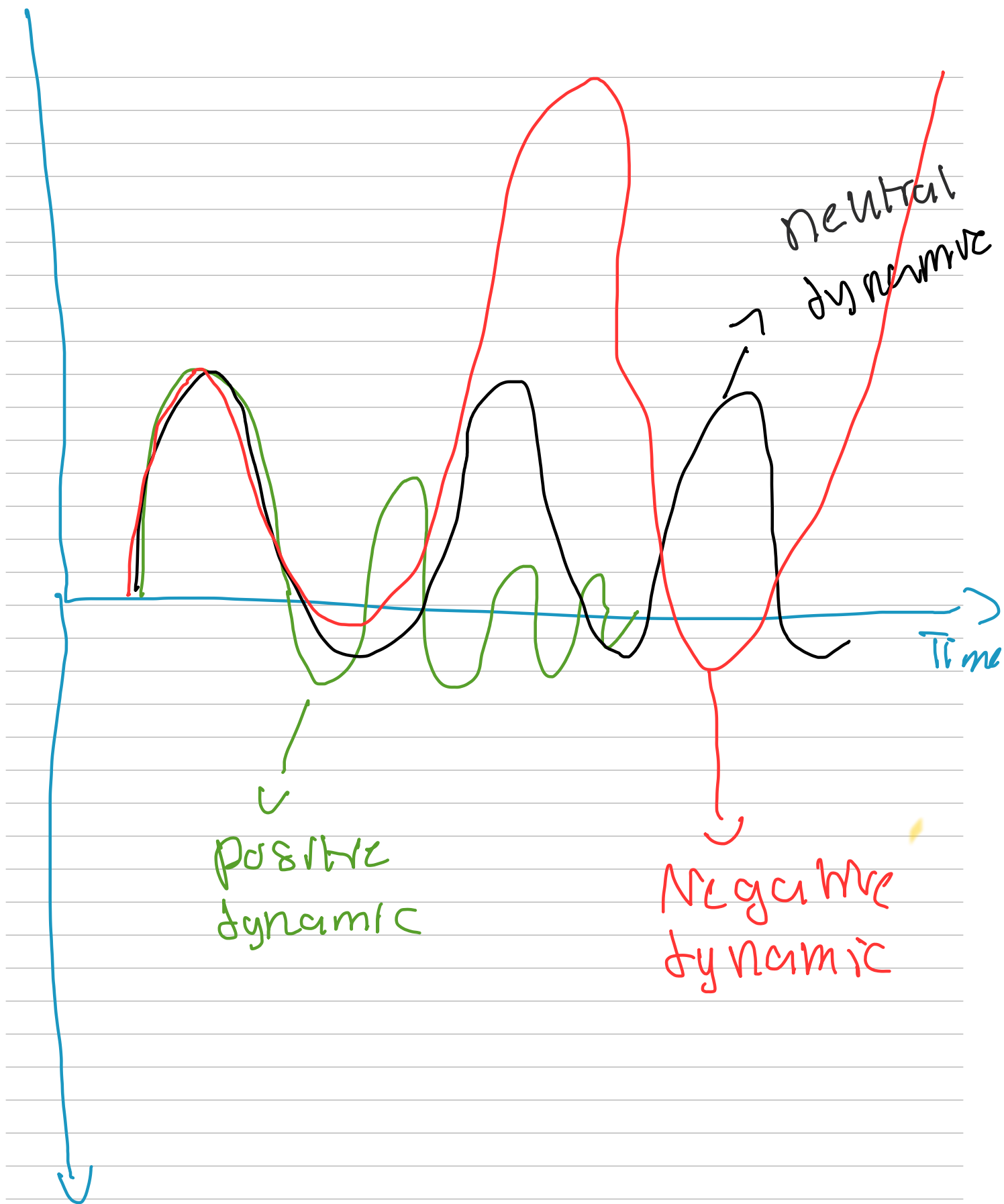
Dynamic ::

positive

neutral

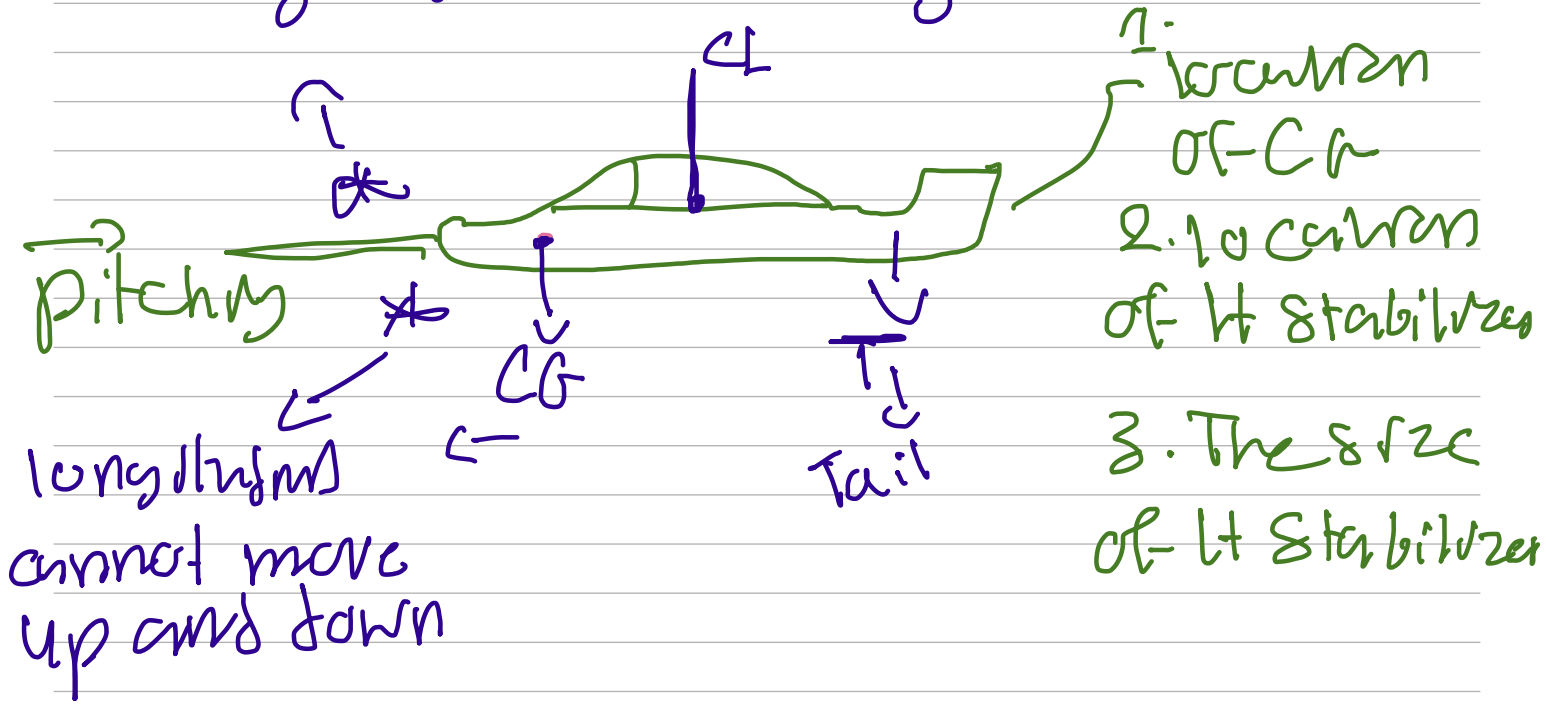
Negative

Displacement



Longitudinal Stability (pitch)

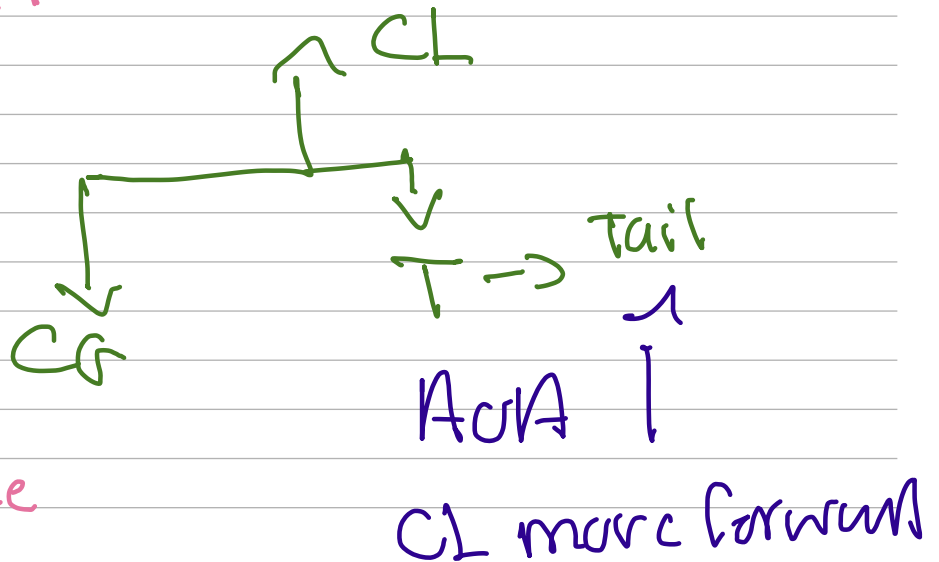
1. longitudinal stability



if these force changes :

The aircraft may move up and down when $A_{CN} \uparrow$,

The center of lift (CL) moved forward, The equilibrium unstable.



كازم يكون جي
سنان تفر الهياره
تلف اذا كانت CL
aline مع CG مارج
تلف ، تلف .

CL can be changed.

Note c_{g0}

1. in aircraft Design CG is in front of CL
2. with $\uparrow$ Alt CL will move forward
3. Horizontal stabilizer is set with a small negative Alt to counter with Nose heaviness.

Dynamic Stability c_{g0}

Nose up $\swarrow$ low speed: wing and tail moment will change and create resulting force

Nose down: moment will adjust and by the nose up.

The factor that effect dynamic

1. downwash

2. power and

power changes.

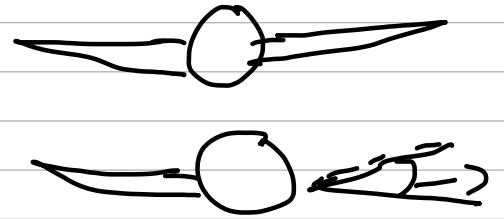
2. power (speed)

3. Thrust line

Lateral Stability (Rolling)

1. Dihedral:

* slight upward angle
of aircraft wing

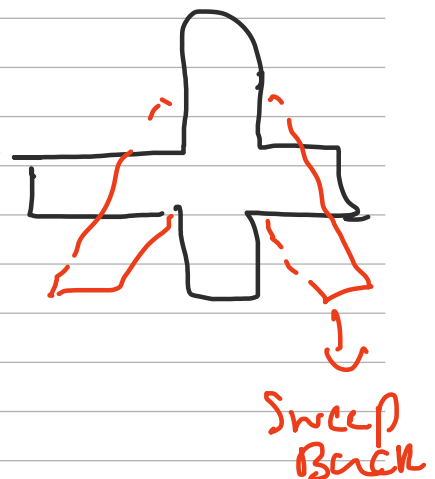


* upward of wing relative
to wing

* Review the Book
for more information
page 4.7

2. Sweepback:

1. addition to dihedral
but TL created when
wing drop from level
position



* leaning edge backward

* refer to the book for more information.

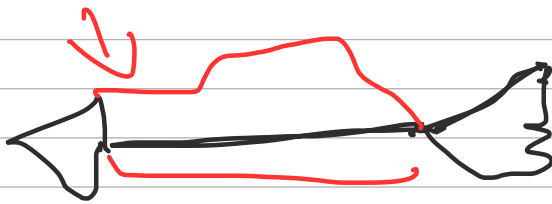
3. Keel Effect 

4. Weight Distribution

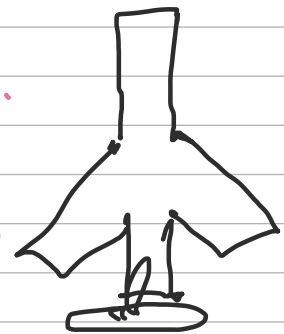
Directional Stability (Yawing)

a. vertical fin of the aircraft

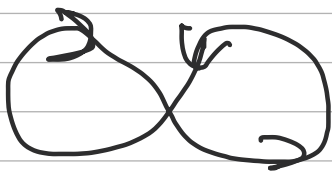
b. fuselage design.



c. wing sweepback.



d. Dutch Roll



* is a coupled lateral / directional oscillation

* usually is dynamic stable

- ✱ usable in aircraft because of oscillatory nature.

- ✱ Controlled by gyro stabilized yaw damper.

- ✱ have both rolling and yawing

- ✱ free to yaw

Passive and Active Stability

Two things that are

often used to describe the stability characteristics of aircraft are

1. passive
2. Active

passive stability :

- ✱ vehicle is naturally (inherently) stable and

- ✱ does not require any artificial stabilization system

- ✱ would require "positive static stability" and "negative dynamic stability"

Active stability

- use artificial stabilizing system to improve the handling of vehicles,

- which do not exhibit sufficient passive stability.

- example

system would be aircraft automatic stabilization system (Basic Autopilot)

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