## **Gyroscopic Effects**

Newtons First Law: "Objects at rest and objects in (constant speed) motion remain in (this) motion in a straight line (same sphere) unless acted by an unbalanced force (torque)."

## Conclusion:

a rotating object '*wants*' to stay in same sphere

"Rigidity in space" gyro instruments

Any (rested or moving) mass has 'inertia': applying a force (torque) does not act immediately: *'it takes time'* to change the objects state (acceleration/desceleration) or to tilt the rotation sphere.

"Precession"

prop effects

Example:

tilt the orbit of a satellite: where/when to apply force?

"90deg ahead of effected location"



# Gyroscopic Effects when flying

The **prop** is a **rotating mass**. (even the engine flywheel is one!). If changing the prop rotation sphere - it results in **Precession**. (not talking about Gyro Instruments here - the effect of a spinning prop only!)

Pitch **90deg 'later'** (clock-wise prop) pitch up right turning pitch down left turning tail wheel take-off: tail up! rotation landing tail dragger has more 'left turning tendency' on take-off Turn turn left pitch up turn right pitch down different trim amount in turns

#### Remark:

Precession happens only on movements (angle changing). If <u>no</u> force (torque) applied then <u>no</u> changes = <u>no</u> precession! (the angle does not matter - just if the angle is changing)

### BTW:

If prop stops ("*dead stick*" = emergency) then there is not any precession effect (neither slip stream + P-factor) = like glider flying

(but adverse yaw is still there = aileron effects!)