

# Infamous Gimbal Lock

Gimbal lock is a pure kinematic problem.

The integration of Euler's differential equations for the rotation of a rigid body is executed in two steps:

1. Integrate angular acceleration  
Result: angular velocity
2. Integrate angular velocity  
Result: Euler angles or quaternion

The system below is equipped with a quaternion attitude controller. The gimbals are only visualizations of Euler angles, they are not necessary here.

What happens if we apply in gimbal lock position a torque about the z-axis of the aircraft?

Gimbal flip! The yaw gimbal rotates  $90^\circ$  and the aircraft is free to move about the z-axis.

