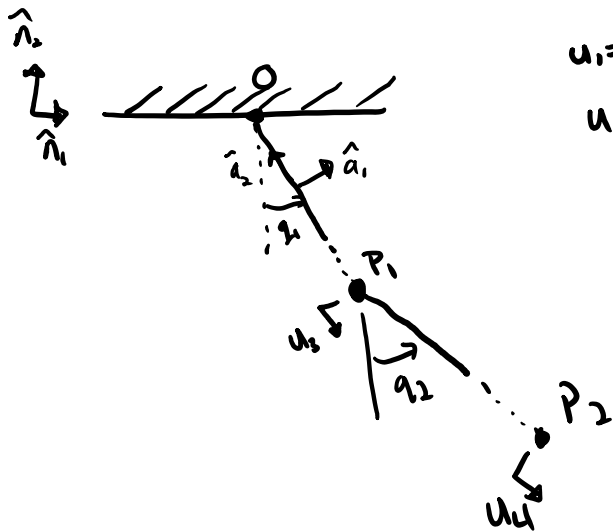
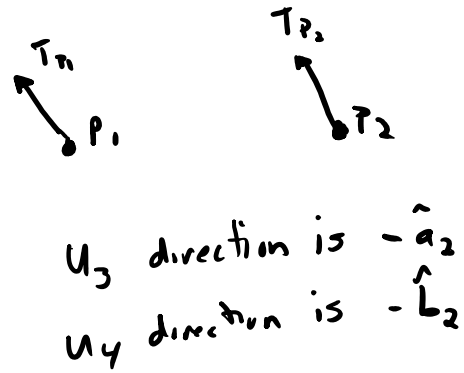


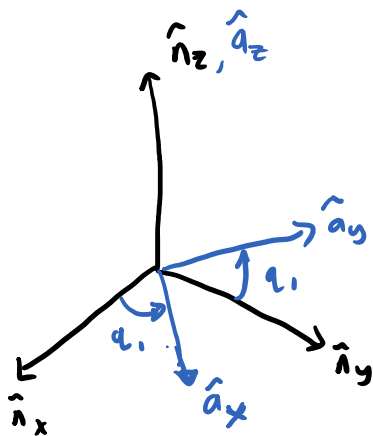
Bringing non-contributing forces & torques into evidence



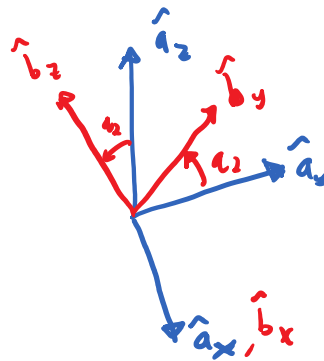
$u_1 = \dot{q}_1$
 $u_2 = \dot{q}_2$



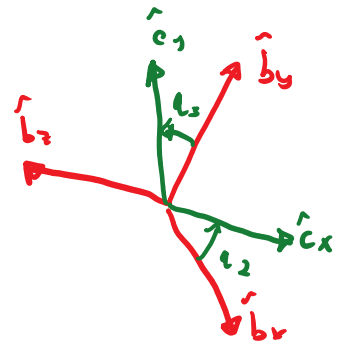
Body Fixed Rotations (each rotation is about an axis that is fixed in the rotating body)



rotate about z through q_1



rotate about x through q_2



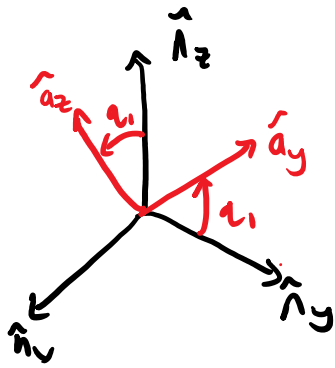
rotate about z through q_3

Body fixed z - x - z rotation through q_1, q_2, q_3
 q_1, q_2, q_3 are also called the z - x - z Euler angles.

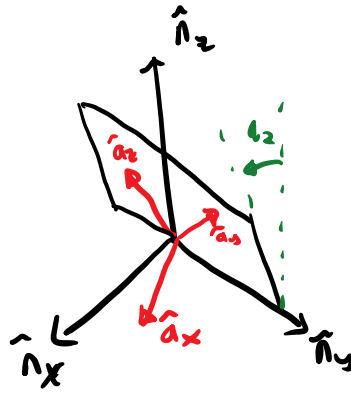
6 possible Euler angles: z - x - z , x - y - x , y - z - y , z - y - z , x - z - x , y - x - y

6 possible Tait-Bryan: x - y - z , y - z - x , z - x - y , x - z - y , z - y - x , y - x - z

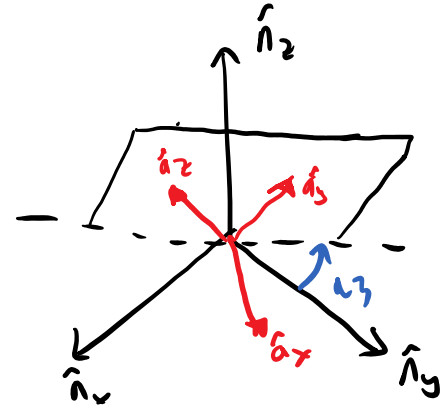
Space Fixed Rotations (each rotation is about the space fixed coordinate system)



$x \ q_1$

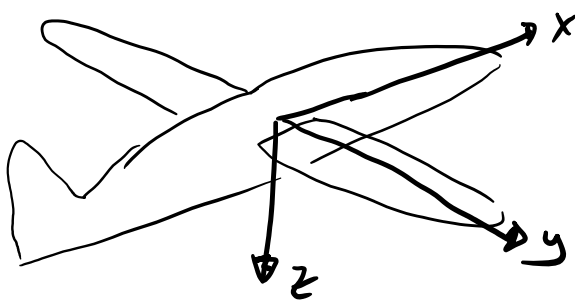


$y \ q_2$



$z \ q_3$

Aircraft



yaw-roll-pitch
z-x-y

Both body and space fixed rotations are subject to gimbal lock.