

VI i)

# Euler Equations

$\vec{r}$  in body fixed frame

$$\frac{d\vec{r}}{dt} = \vec{r} \times \Omega + \text{fixed part } \vec{v}_{cm}$$

this is true for all body fixed vectors

$$\frac{d\vec{A}}{dt} = \vec{A} \times \Omega$$

When  $\vec{A}$  changes in moving system then

$$\frac{d\vec{A}}{dt} = \frac{d'\vec{A}}{dt} + \vec{\Omega} \times \vec{A}$$

↑  
moving system

↑  
lab system

Eqs of motion:  $\frac{d'\vec{p}}{dt} + \vec{\Omega} \times \vec{p} = \vec{F}$

$$\frac{d'\vec{M}}{dt} + \vec{\Omega} \times \vec{M} = \vec{K}$$

Use principle axis in moving frame and write equations in moving frame

$$\Rightarrow \frac{dp_1}{dt} + \Omega_2 p_3 - \Omega_3 p_2 = F_1$$

$$\frac{dp_2}{dt} + \Omega_3 p_1 - \Omega_1 p_3 = F_2$$

$$\frac{dp_3}{dt} + \Omega_1 p_2 - \Omega_2 p_1 = F_3$$