List of derivations for minor (symbols have their usual meanings)

1) Derive the angular momentum of an RB about a moving point A w.r.t ref. frame F

$$\underline{H}_{A|F} = \underline{H}_{C|F} + m(\underline{r}_{CA} \times \underline{v}_{CA|F})$$

where, $\underline{H}_{A|F} = \int_{body} (\underline{r}_{PA} \times v_{PA|F})\, dm$ and pt C is the COM of the RB

2) Given 1) $\underline{H}_{A|I} = H_{C|I} + m(\underline{r}_{CA} \times \underline{v}_{CA|I})$,
2) $\frac{d}{dt}\{\underline{H}_{O|I}\}\big|_I = \underline{M}_O$ (Euler's 2nd axiom)

derive:

$$\frac{d}{dt}\{\underline{H}_{A|I}\}\big|_I = \dot{\underline{H}}_{A|I} = \underline{M}_A - (\underline{r}_{CA} \times m\, a_{A|I})$$

where A is a moving pt w.r.t an inertia frame I and $\underline{M}_A$ is the net moment due to all external forces acting on the RB about point A. O is a point fixed to I.

3) Starting from the defition of angular momentum of an RB as $\underline{H}_{A|F} = \int (\underline{r}_{PA} \times \underline{v}_{PA|F})\, dm$

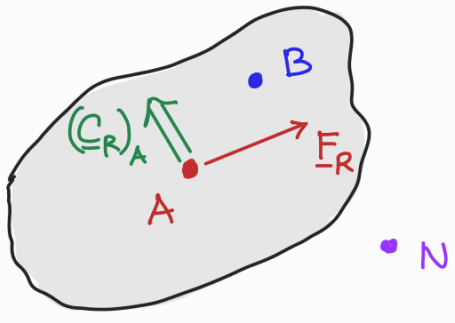
derive the relationship between the angular momentum about a point A fixed on RB ($\underline{H}_{A|F}$) to the angular velocity $\underline{\omega}_{m|F}$

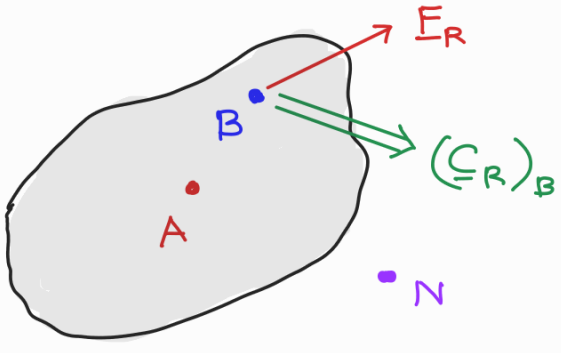
$$(\underline{H}_A)_i = I^A_{ij}\, \omega_j \,, \quad \text{where} \quad I^A_{ij} = \int (r^2 \delta_{ij} - x_i x_j)\, dm$$

Note: $|\underline{r}_{PA}| = r$

and $\underline{r}_{PA} = x_1 \hat{e}_1 + x_2 \hat{e}_2 + x_3 \hat{e}_3 = x_p \hat{e}_p$

4) Given two force systems (left and right)





Find the relationship between $(\underline{C}_R)_A$ and $(\underline{C}_R)_B$ if the net resultant moments of the two systems about pt A is the same. i.e. $\underline{M}_A = M'_A$

Further, prove that $\underline{M}_N = \underline{M}'_N$, where N is another point in space (no restrictions)