Angular momentum

Definition.

$$\vec{j} = \vec{r} \times \vec{p} \qquad \text{(D15)}$$

$$\vec{J} = \sum \vec{j}_i = \sum \vec{r}_i \times \vec{p}_i \qquad \text{(D15')}$$

Variation of angular momentum. The time variation of angular momentum equals the momentum of total external forces acting upon the system:

$$\frac{d\vec{j}}{dt} = \vec{r} \times \vec{F} \qquad \text{(D16)}$$

$$\frac{d\vec{J}}{dt} = \sum \vec{r}_i \times \vec{F}_{iext} \qquad \text{(D16')}$$

For the demonstration see class lectures. Faceti va rog demonstratia pt 1D. Pt 3D doar daca credeti ca merge.

Examples: Central forces, experience in class: the door can't be moved if I push towards the rotation axis . The force in a central field is collinear to the radius vector: $\vec{F} = a\vec{r}$ (a<0 for attraction). Hence $\vec{M} = \vec{r} \times a\vec{r} = 0$ and **in a central field the angular momentum is constant as a vector**; **the trajectory is planar.**

General remarks for variation and conservation of energy, momentum and angular momentum.

Variation theorems give alternative solutions to the mechanics problems, often easier than the usual involving Newton's laws (remember Galileo formula).

Conservation conditions do the same in a more drastic way:

- The conservation of the angular momentum permits to say that the movement is plane, thus reducing the number of variables (three in space, two in plane)
- The conservation of energy or of momentum reduces the number of variables and gives some limits to the movement

See applications in the chapter *Central field*