① 运动学.

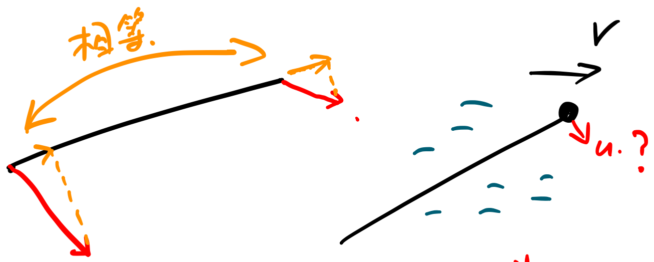
坐标. 位移. 速度. 加速度. 直角坐标. 极坐标. 球坐标.

$$\begin{cases} x = f(t) \\ y = g(t) \end{cases}$$

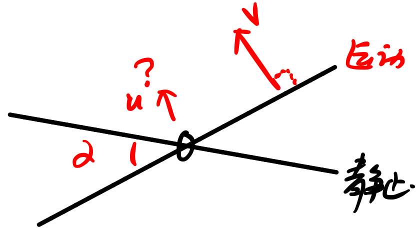
$$\begin{cases} r = f(t) \\ \theta = g(t) \end{cases}$$

求速度. 加速度. 轨道方程

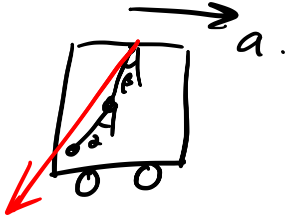
速度的限制

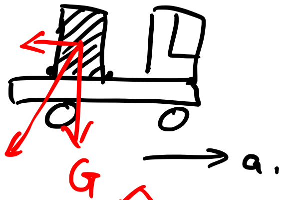


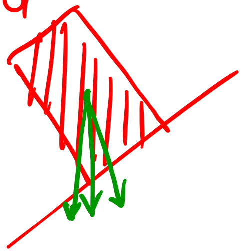
相对速度. 相对加速度.



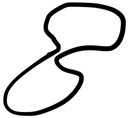
非惯性参考系. 惯性力. 等效原理.







功. 能. 保守力.



力势. $F_x = -\frac{\partial V}{\partial x}$

$F_y = -\frac{\partial V}{\partial y}$

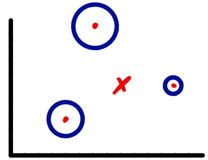
......

角动量. 角动量守恒, 角动量定理 $\frac{dJ}{dt} = M$.

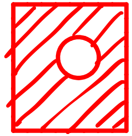
机械能守恒.

比耐公式 $h^2u^2\left(\frac{d^2u}{d\theta^2}+u\right) = -\frac{F}{m}$

质点组.

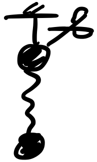


质心. $m_c = \dfrac{\sum_{i=1}^{n} m_i \cdot \vec{r}_i}{\sum_{i=1}^{n} m_i}$



连续. $m_c = \dfrac{\int \vec{r}\, \rho \cdot d\sigma}{\int \rho \, d\sigma}$ — 总质量.

外力和质心的关系. $m_{总} \ddot{x}_c = F_{外}$



动量矩定理.

角动量守恒.

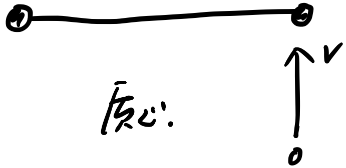
转动惯量

平行轴定理.

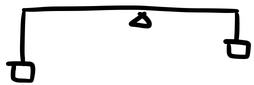
变质量物体的运动

(火箭. 水滴)

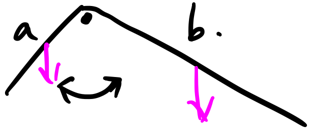
$$\frac{d(m\vec{v})}{dt} - \frac{dm}{dt}\vec{u} = \vec{F}$$



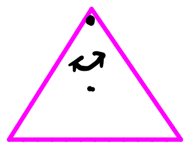
…完全非弹性碰撞.



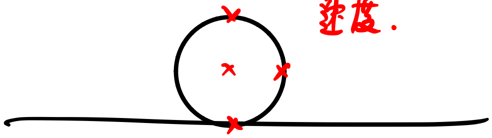
求加速度.



求周期.



刚体的转动瞬轴



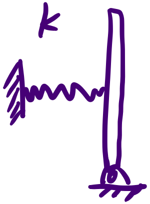
动能

刚体的平衡:

$$\begin{cases} x.\ y.\ z \text{ — 力平衡.} \\ x.\ y.\ z \text{ — 力矩平衡.} \end{cases}$$

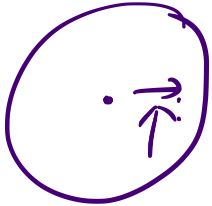
$\begin{cases} \text{稳定} \\ \text{不稳定.} \end{cases}$

机械能守恒.



柯尼希定理 $\frac{1}{2} m v_c^2 + \frac{1}{2} I_c \omega^2$

转动参考系. 柯里奥利力



旋转杯子.

分析力学

自由度.　　广义坐标　　广义力

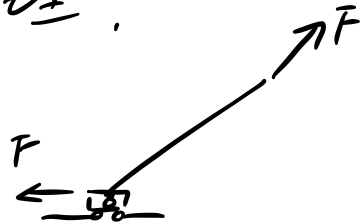
广义力的求法：

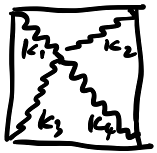
$$Q_a = \sum_{i=1}^{n}\left(\vec{F}_i \cdot \frac{\partial \vec{r}_i}{\partial q_a}\right) + \sum_{j=1}^{m}\left(\vec{M}_j \cdot \frac{\partial \vec{\theta}_j}{\partial q_a}\right)$$

广义力的求法：（若力为保守力）.

$$Q_a = -\frac{\partial V_{总}}{\partial q_a}$$

静力学 — 虚功原理





求p点的坐标.

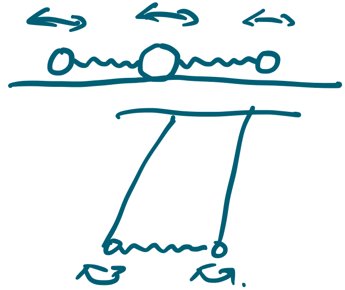
$$\text{虚功} = \frac{\partial V}{\partial q_1} \cdot \delta q_1$$

虚位移

动力学. 拉格朗日方程.

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_\alpha}\right)-\frac{\partial L}{\partial q}=0$$

多自由度体系的小振动.



正则哈密顿方程.

$$\begin{cases}\dot{q}_\alpha=\dfrac{\partial H}{\partial p_\alpha}\\ \dot{p}_\alpha=-\dfrac{\partial H}{\partial q_\alpha}\end{cases}$$

哈密顿量.

$$H=-L+\sum_{\alpha=1}^{s}p_\alpha\cdot\dot{q}_\alpha$$

泊松括号.

$$\frac{d\varphi}{dt} = \frac{\partial\varphi}{\partial t} + [\varphi . H]$$

其中 $$[\varphi . H] = \sum_{\alpha=1}^{s}\left(\frac{\partial\varphi}{\partial q_\alpha}\cdot\frac{\partial H}{\partial p_\alpha} - \frac{\partial\varphi}{\partial p_\alpha}\frac{\partial H}{\partial q_\alpha}\right).$$

$$\begin{cases} \dot{p}_\alpha = [p_\alpha . H] \\ \dot{q}_\alpha = [q_\alpha . H] \end{cases}$$ 正则方程.