Dyn I.

II. NEWTONŮV ZÁKON

Změna velikosti pohybu je úměrná působící síle a děje se ve směru jejího působení.

hybnost

$$\frac{d\vec{p}}{dt} = \vec{F} \quad , \quad \vec{p} = m \cdot \vec{v} \qquad \dot{m} \qquad \vec{a}$$

$$\frac{d(m\cdot\vec{v})}{dt} = \vec{F} \Rightarrow \frac{d(m\cdot\vec{v})}{dt} = \frac{dm}{dt}\vec{v} + m\cdot\frac{d\vec{v}}{dt}$$

$\vec{F}$ – vnější síla

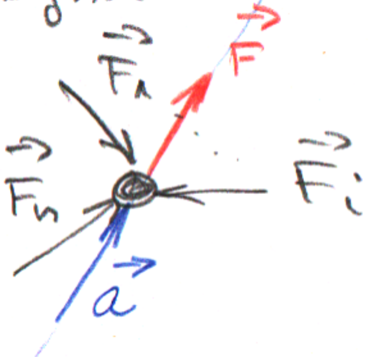
$$\boxed{\vec{F} = \underbrace{\dot{m}\vec{v}}_{\text{reaktivní síla}} + m\vec{a}} \xrightarrow{m=\text{konst.}} \boxed{\vec{F} = m\cdot\vec{a}}$$

m – hmotnost x tíha

$\vec{a}$ – míra změny rychlosti bodu

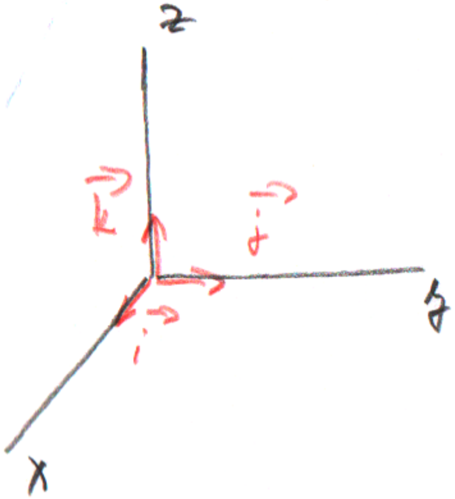
$\vec{F}$ – vzájemné působení těles

Dynamika hmotného bodu



$$\vec{F} = \sum_{i=1}^{n} \vec{F}_i = \sum_i \vec{F}_i$$

$$\vec{F} = m \cdot \vec{a}$$



$$\vec{a} = a_x \cdot \vec{i} + a_y \cdot \vec{j} + a_z \cdot \vec{k}$$

$$\vec{F}_i = F_{ix} \cdot \vec{i} + F_{iy} \cdot \vec{j} + F_{iz} \cdot \vec{k}$$

$$m \vec{a} = \sum_i \vec{F}_i$$

$$m \cdot a_x = \sum_i F_{ix}$$

$$m \, a_y = \sum_i F_{iy}$$

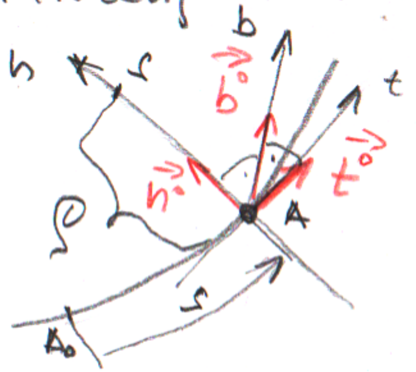
$$m \cdot a_z = \sum_i F_{iz}$$

$$a_x = \frac{d v_x}{dt} = \frac{d^2 x}{dt^2} = v_x \frac{d v_x}{dx} = \frac{d(v_x^2)}{2dx} = \dot{v}_x = \ddot{x}$$

$$a_y = \ldots$$

$$a_z = \ldots$$

Přirozený souřadnicový systém



$$\vec{a} = a_t \cdot \vec{t^\circ} + a_n \cdot \vec{n^\circ} + 0 \cdot \vec{b^\circ}$$

$$\vec{F_i} = F_{i_t} \cdot \vec{t^\circ} + F_{in} \cdot \vec{n^\circ} + F_{i_b} \cdot \vec{b^\circ}$$

$$m \cdot a_t = \sum_i F_{it}$$

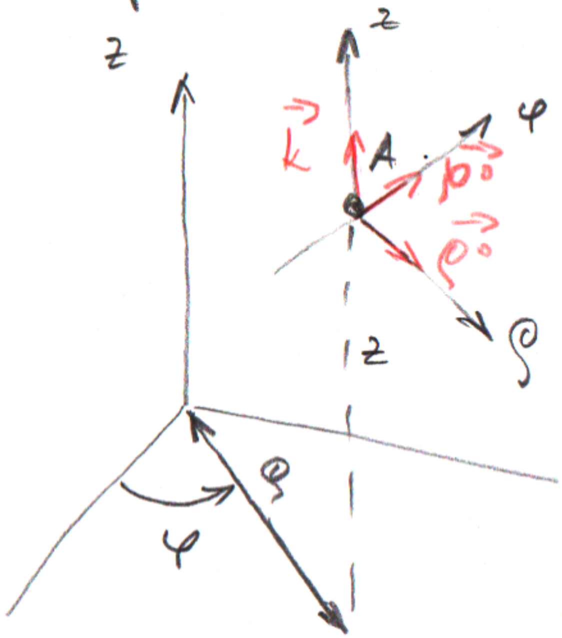
$$m \cdot a_n = \sum_i F_{in}$$

$$0 = \sum_i F_{ib}$$

$$a_t = \frac{dv}{dt} = \frac{d^2 s}{dt^2} = \frac{d(v^2)}{2 \cdot ds}$$

$$a_n = \frac{v^2}{\rho} \quad , a_b = 0$$

Válcový s. s.



$\vec{\rho^0}$ – radiální
$\vec{\varphi^0}$ – transverzální
$\not z\ \vec{k}$ – axiální

$$\vec{a} = a_\rho \cdot \vec{\rho^0} + a_\varphi \cdot \vec{\varphi^0} + a_z \vec{k}$$
$$\vec{F_i} = F_{i\rho} \cdot \vec{\rho_0} + F_{i\varphi} \cdot \vec{\varphi^0} + F_z \vec{k}$$
$$m \cdot a_\rho = \sum_i F_{i\rho}$$
$$m \cdot a_\varphi = \sum_i F_{i\varphi}$$
$$m \cdot a_z = \sum_i F_{iz}$$

$$a_\rho = \ddot{\rho} - \rho \dot{\varphi}^2$$
$$a_\varphi = \rho \ddot{\varphi} + 2 \dot{\rho} \dot{\varphi}$$
$$a_z = \ddot{z}$$

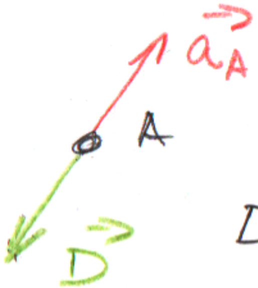
D'Alembertův princip

$$\sum_i \vec{F_i} = m \cdot \vec{a}$$

$$\sum_i \vec{F_i} \underbrace{- m \cdot \vec{a}}_{\vec{D}} = \vec{0}$$

$$\vec{D} = - m \cdot \vec{a}$$

$$\sum_i \vec{F_i} + \vec{D} = \vec{0}$$



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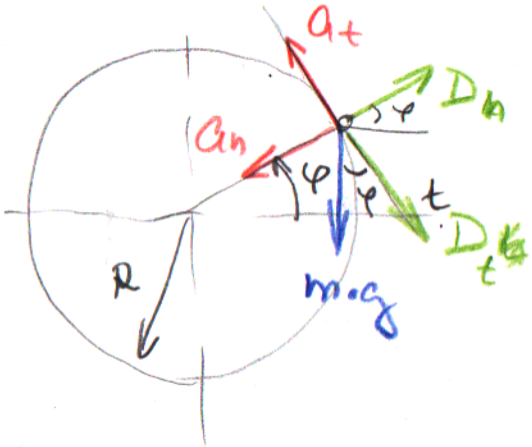
$D = \oplus m \cdot a_A$

$D = - m \cdot a$



$$D_n = m \cdot a_n = m \cdot R\, \dot{\varphi}^2$$

$$D_t = m \cdot a_t = m \cdot R\, \ddot{\varphi}$$

$$\nearrow n: \; D_n - m \cdot g \sin\varphi = 0$$

$$\nwarrow t: \; -D_t - m \cdot g \cos\varphi = 0$$