Alan Teorisi

Ders 2: Hareket yasası, kütle-hız ilişkisi, elektriksel etkileşim

Orijinal not: Ders2.pdf

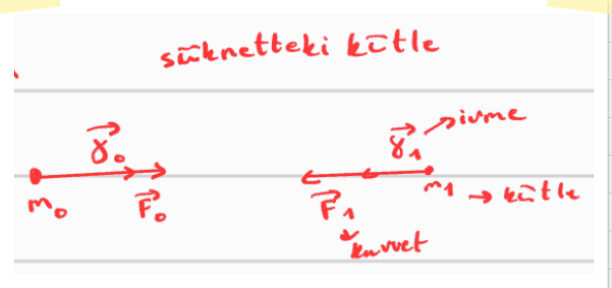
UYARI Bu belge, el yazısı ders notlarından Claude (Anthropic) yardımıyla dijitale aktarılmıştır. Yardımcı kaynak olarak hazırlanmıştır; hata veya eksik içerebilir. Lütfen orijinal notları ve ders kaynaklarını esas alın.

NOTICE *This document was transcribed from handwritten lecture notes with the help of Claude (Anthropic). It is meant as a supplementary resource and may contain errors or omissions. Always check against the original notes and official course material.*

orj. s. 1

Çekme yasası

sükunetteki kütle



orijinal çizim, s. 1

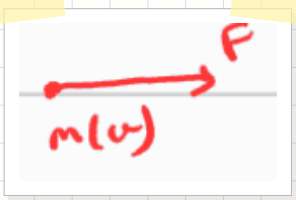
$$m_1 = \frac{\gamma_0}{\gamma_1} m_0$$

$$\vec{F}_0 = m_0\vec{\gamma}_0 = -m_1\vec{\gamma}_1 = -\vec{F}_1$$

$$\vec{F}_0 = m_0\frac{d\vec{v}_0}{dt} = -m_1\frac{d\vec{v}_1}{dt}$$

$$\vec{F}_0 = \frac{d}{dt}[m_0\vec{v}_0]$$

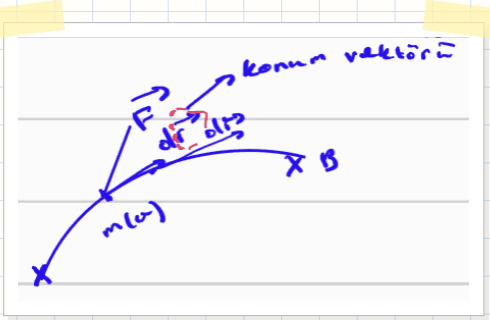
Hareket yasası



orijinal çizim, s. 1

$$\Rightarrow \vec{F} = \frac{d}{dt}\left[m(v)\,\vec{v}\right]$$

$$m(v) = \frac{m_0}{\sqrt{1 - \frac{v^2}{c_0^2}}}$$



orijinal çizim, s. 1

$$\vec{v} = \frac{d\vec{r}}{dt} \quad \Rightarrow \quad d\vec{r} = \vec{v}\,dt$$

$$\frac{d}{dt}\left[m(v)\vec{v}\right]\cdot\vec{v} = \left[\frac{dm(v)}{dt}\,\vec{v} + m(v)\,\frac{d\vec{v}}{dt}\right]\cdot\vec{v}$$
$$= \frac{dm(v)}{dt}\,\underbrace{\vec{v}\cdot\vec{v}}_{v\cdot v} + m(v)\,\underbrace{\frac{d\vec{v}}{dt}\cdot\vec{v}}_{\frac{d\vec{v}}{dt}\parallel\vec{v}\;\Rightarrow\;\frac{dv\cdot v}{dt}}$$

$$\text{iş} = W_{AB} = \int_A^B \vec{F}\cdot d\vec{r} = \int_A^B \frac{d}{dt}\left[m(v)\cdot\vec{v}\right]\vec{v}\,dt$$

$$\Rightarrow = \int_A^B \frac{d}{dt}\left[m(v)\,\vec{v}\right]\cdot v\,dt$$

$$\Rightarrow \boxed{\begin{aligned}&\int f'(t)\,g(t)\,dt\\ &= f(t)\,g(t)\\ &- \int f(t)\,g'(t)\,dt\end{aligned}} \qquad \boxed{\vec{a}\cdot\vec{a} = a^2}$$

$$= m(v)\,v\cdot v\Big|_A^B - \int_A^B m(v)\,v\,\frac{dv}{dt}\,dt \qquad = \frac{dm(v)}{dt}\,v^2 + m(v)\,\frac{dv}{dt}\,v = \frac{d}{dt}\left[m(v)\,v\right]\cdot v$$

$$= m(v_B)\,v_B^2 - m(v_A)\,v_A^2 - \int_A^B \frac{m_0\,v}{\sqrt{1 - \frac{v^2}{c_0^2}}}\,dv$$

$$= W_{AB} = \frac{m_0}{\sqrt{1-\frac{v_B^2}{c_0^2}}} v_B^2 - \frac{m_0}{\sqrt{1-\frac{v_A^2}{c_0^2}}} v_A^2 + \frac{c_0^2 m_0}{2} \int_A^B \left(1-\frac{v^2}{c_0^2}\right)^{-1/2} \left(\frac{-2v}{c_0^2}\right) dv$$

$$\longrightarrow \frac{\left(1-\frac{v^2}{c_0^2}\right)^{1/2}}{1/2} \Bigg|_A^B$$

$$\int f^n(x) f'(x)\, dx = \frac{f^{n+1}(x)}{n+1} + C$$

$$= \frac{m_0 v_B^2}{\sqrt{1-\frac{v_B^2}{c_0^2}}} - \frac{m_0 v_A^2}{\sqrt{1-\frac{v_A^2}{c_0^2}}} + \frac{c_0^2 m_0}{2} \left[2\left(1-\frac{v_B^2}{c_0^2}\right)^{1/2} - 2\left(1-\frac{v_A^2}{c_0^2}\right)^{1/2}\right]$$

$$= \frac{m_0}{\sqrt{1-\frac{v_B^2}{c_0^2}}} \left[v_B^2 + c_0^2\left(1-\frac{v_B^2}{c_0^2}\right)\right] - \frac{m_0}{\sqrt{1-\frac{v_A^2}{c_0^2}}} \left[v_A^2 + c_0^2\left(1-\frac{v_A^2}{c_0^2}\right)\right]$$

(Her iki köşeli parantezde v^2 ve $-v^2/c_0^2 \cdot c_0^2$ terimleri çizilmiş; parantezlerin üstüne "c_0^2" yazılmış.)

orj. s. 2

$$= m_0 c_0^2 \left[\frac{1}{\sqrt{1-\frac{v_B^2}{c_0^2}}} - \frac{1}{\sqrt{1-\frac{v_A^2}{c_0^2}}}\right]$$

binom açılımı çok küçük $v_A/v_B \ll c_0$

$$\left(1-\frac{v_{A/B}^2}{c_0^2}\right)^{-1/2} \approx 1 + \frac{1}{2}\frac{v_{A/B}^2}{c_0^2}$$

$$\approx m_0 c_0^2 \left[1 + \frac{1}{2}\frac{v_B^2}{c_0^2} - 1 + \frac{1}{2}\frac{v_A^2}{c_0^2}\right] = \frac{1}{2} m_0 v_B^2 - \frac{1}{2} m_0 v_A^2$$

$$\approx \frac{1}{2} m_0 \left(v_B^2 - v_A^2\right)$$

Elektriksel etkileşim yasası

$$e \approx -1{,}6 \cdot 10^{-19}\ \mathrm{C}$$

$$p = -e$$

Şekil: Bu sayfa basılı materyal içeriyor (ör. ders slaytı); dijitalleştirilmedi.
(orijinal notta, s. 2)