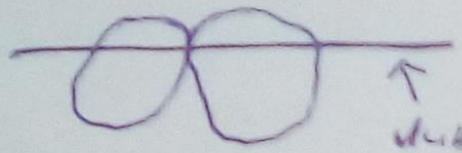
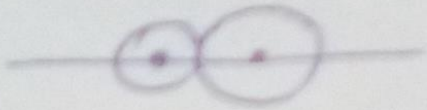
Физика 1
предавање (10.4.2020.)

Горан Попарић

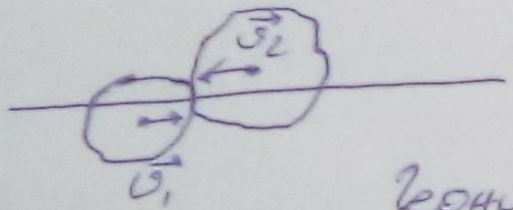
Удари



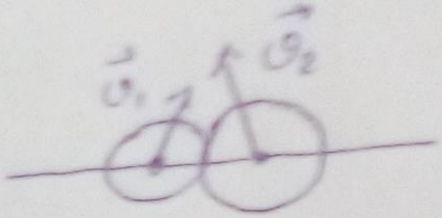
лінійне удар

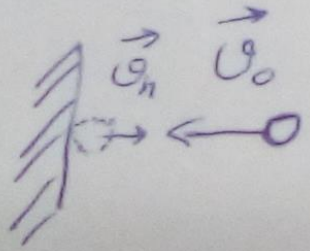


центральний удар



косий удар



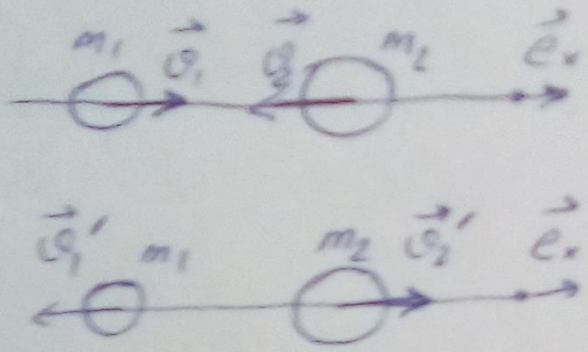


$$\varepsilon = \frac{\vartheta_n}{\vartheta_0}$$

$0 \leq \varepsilon \leq 1$

коефіцієнт реституції

Абсолютно упругий удар (центральный)



1) $m_1\vec{v}_1 + m_2\vec{v}_2 = m_1\vec{v}_1' + m_2\vec{v}_2'$ |

2) $\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2$

1) → 3) $m_1(v_1 - v_1') = m_2(v_2' - v_2)$

2) → 4) $m_1(v_1^2 - v_1'^2) = m_2(v_2'^2 - v_2^2)$

4)/3) → 5) $v_1 + v_1' = v_2' + v_2$

5)·m_1 + 3) → 6) $2m_1v_1 = m_1v_2' + m_1v_2 + m_2v_2' - m_2v_2$

6) → 7) $v_2' = \frac{2m_1v_1 - (m_1 - m_2)v_2}{m_1 + m_2}$

8) $v_1' = \frac{2m_2v_2 - (m_2 - m_1)v_1}{m_1 + m_2}$

Абсолютно еластичан удар

$$v_2' = \frac{2m_1 v_1 - (m_1 - m_2) v_2}{m_1 + m_2}$$

$$v_1' = \frac{2m_2 v_2 - (m_2 - m_1) v_1}{m_1 + m_2}$$

Нека је: $v_1 = 0$

$$v_2' = \frac{2m_1 v_1}{m_1 + m_2}$$

$$v_1' = -\frac{m_2 - m_1}{m_1 + m_2} v_1$$

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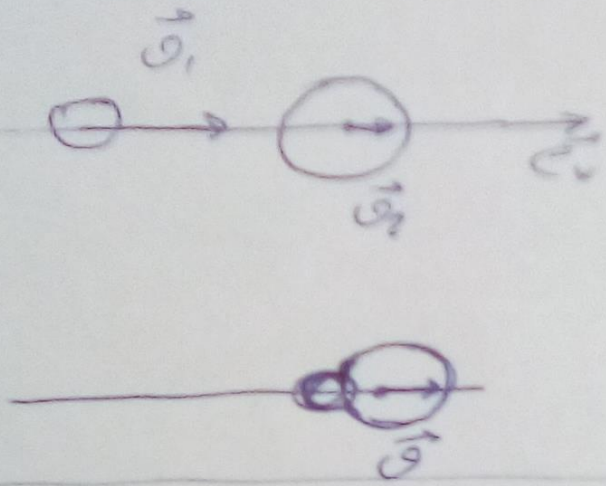
1) случај: $m_1 = m_2 \Rightarrow v_2' = v_1 \quad v_1' = 0$ (билијар)

2) случај: $m_1 > m_2 \Rightarrow v_2' > v_1$

3) случај: $m_1 < m_2 \Rightarrow v_2' < v_1$

4) $m_1 << m_2 \Rightarrow v_1' \approx -v_1$

Апсолутно нецентрични судар (централни)



$$m_1\vec{v}_1 + m_2\vec{v}_2 = (m_1+m_2)\vec{v} \quad / \vec{e}_x$$

$$v = \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2}$$

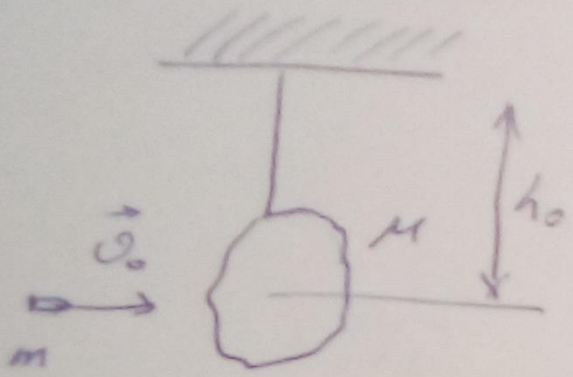
$$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2}(m_1+m_2)v^2 + E_{def}$$

v^2

Ако је $v_2 = 0 \Rightarrow E_{def} = \frac{1}{2} m_1 v_1^2 - \frac{1}{2}(m_1+m_2) \cdot \frac{m_1^2 v_1^2}{(m_1+m_2)^2}$

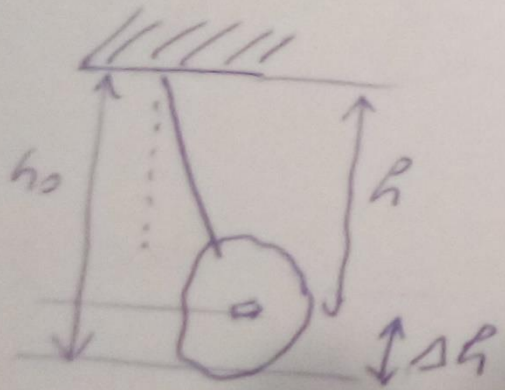
$$\Rightarrow E_{def} = \frac{1}{2} \frac{m_1 m_2}{m_1+m_2} v_1^2 = E_{k_1} \cdot \frac{1}{1+m_1/m_2}$$

Баллистический маятник



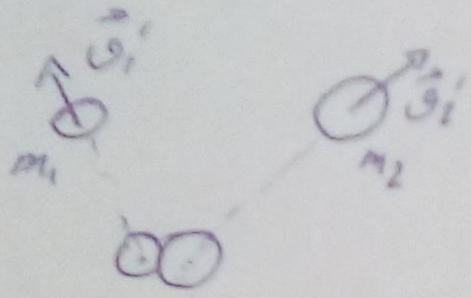
$$mv_0 = (m+M)v \Rightarrow v = \frac{m}{m+M}v_0$$

$$\frac{1}{2}(m+M)v^2 = (m+M)g\cdot\Delta h$$



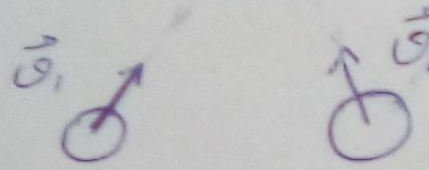
$$\Rightarrow v_0 = \frac{m+M}{m}\cdot\sqrt{2g\cdot\Delta h}$$

Кос судар двеју лопти (апсолутно еластичан)



1) $\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2$

2) $m_1\vec{v}_1 + m_2\vec{v}_2 = m_1\vec{v}_1' + m_2\vec{v}_2' \;/\vec{i}, \vec{j}, \vec{k}$



2) $\Rightarrow$
$$\begin{cases} m_1v_{1x} + m_2v_{2x} = m_1v_{1x}' + m_2v_{2x}' \\ m_1v_{1y} + m_2v_{2y} = m_1v_{1y}' + m_2v_{2y}' \\ m_1v_{1z} + m_2v_{2z} = m_1v_{1z}' + m_2v_{2z}' \end{cases}$$

У равни:
непознате ($v_{1x}', v_{1y}', v_{2x}', v_{2y}'$) 4 непознате, а 3 једначине

У простору:
нез. ($v_{1x}', v_{1y}', v_{1z}', v_{2x}', v_{2y}', v_{2z}'$) 6 непознатих, а 4 једначине