REAL COLLISION

One of the simplest theory of impact (collision) is Newton's theorem:

$$\varepsilon = -\frac{v_1^* - v_2^*}{v_1 - v_2}$$

ε ... coefficient of restitution $\quad \varepsilon \in \langle 0; 1 \rangle$

v_1, v_2 ... velocity of particle 1, 2 before collision

v_1^*, v_2^* ... — " — — " — after — " —

$\varepsilon = 1$ .... perfectly elastic collision

$\varepsilon = 0$ .... — " — plastic — " —

$$\boxed{v_1^* - v_2^* = -\varepsilon (v_1 - v_2)}$$

How to solve task on collision (real):

(1) $m_1 v_1 + m_2 v_2 = m_1 v_1^* + m_2 v_2^*$

(2) $v_1^* - v_2^* = -\varepsilon (v_1 - v_2)$

$$\left.\begin{array}{ll} (1) & v_1 - v_1^* = \frac{m_2}{m_1}(v_2^* - v_2) \\ (2) & \varepsilon v_1 + v_1^* = \varepsilon v_2 + v_2^* \end{array}\right\} (+)$$

$$(1+\varepsilon) v_1 = v_2^* \left(1 + \frac{m_2}{m_1}\right) + v_2 \left(\varepsilon - \frac{m_2}{m_1}\right)$$

$$v_2^* \frac{m_1+m_2}{m_1} = (1+\varepsilon) v_1 - v_2 \frac{\varepsilon m_1 - m_2}{m_1}$$

$$v_2^* = \frac{(1+\varepsilon) m_1 v_1 - v_2 (\varepsilon m_1 - m_2)}{m_1 + m_2}$$

$$v_1^* = \frac{(1+\varepsilon) m_2 v_2 - v_1 (\varepsilon m_2 - m_1)}{m_1 + m_2}$$

Energy ballance:

$$W = K^* - K = \dots = -\frac{1}{2} \frac{m_1 m_2}{m_1 + m_2} (1 - \varepsilon^2) (v_1 - v_2)^2$$