Kļūdu aprēķini

Eksperimentālo ātrumu kļūdas

$$\Delta v_{l,n} = \sqrt{\left(\frac{\partial v_{l,n}}{\partial m_r}\cdot \Delta m_r\right)^2 + \left(\frac{\partial v_{l,n}}{\partial m_l}\cdot \Delta m_l\right)^2 + \left(\frac{\partial v_{l,n}}{\partial \overline{s}_n}\cdot \Delta \overline{s}_n\right)^2 + \left(\frac{\partial v_{l,n}}{\partial l}\cdot \Delta l\right)^2}$$

$$\frac{\partial v_{l,n}}{\partial m_r} = \frac{1}{m_l}\overline{s}_n\sqrt{\frac{g}{l}}$$

$$\frac{\partial v_{l,n}}{\partial m_l} = -\frac{m_r}{m_l^2}\cdot \overline{s}_n\sqrt{\frac{g}{l}}$$

$$\frac{\partial v_{l,n}}{\partial \overline{s}_n} = \left(1+\frac{m_r}{m_l}\right)\sqrt{\frac{g}{l}}$$

$$\frac{\partial v_{l,n}}{\partial l} = \left(1+\frac{m_r}{m_l}\right)\cdot \overline{s}_n\frac{\sqrt{g}}{-2l^{1,5}}$$

	$\frac{\partial v_{l,n}}{\partial m_r}$	$\frac{\partial v_{l,n}}{\partial m_l}$	$\frac{\partial v_{l,n}}{\partial \overline{s}_n}$	$\frac{\partial v_{l,n}}{\partial l}$	$\Delta v_{l,n}, \mathrm{cm}$	$v_{l,n}, \mathrm{cm}$
$n=1$	$20,2149$	$-168,2090$	$32,9981$	$-1,6615$	$0,3713$	$2,6003 \pm 0,3173$
$n=2$	$18,5218$	$-154,1205$	$32,9981$	$-1,5223$	$0,3650$	$2,3852 \pm 0,365$
$n=3$	$16,2643$	$-135,3357$	$32,9981$	$-1,3368$	$0,3573$	$2,0921 \pm 0,3573$
$n=4$	$13,4937$	$-112,2817$	$32,9981$	$-1,1091$	$0,3490$	$1,7357 \pm 0,349$
$n=5$	$10,2614$	$-85,3853$	$32,9981$	$-0,8434$	$0,3411$	$1,3199 \pm 0,3411$

Teorētisko ātrumu kļūdas

a) Teorētiskais lodītes kustības ātrums, ievērojot lodītes rotāciju

$$v_{v+r} = \sqrt{\frac{10}{7}gH}$$

$$\Delta v_{v+r} = \frac{\partial v_{v+r}}{\partial H}\cdot \Delta H$$

$$\frac{\partial v_{v+r}}{\partial H} = \sqrt{\frac{10}{7}g}\cdot\frac{1}{2\sqrt{H}}$$

$$\Delta H = \sqrt{\Delta H_{\text{gad.}}^2 + \Delta H_\delta^2}$$

$$\Delta H_{\text{gad.}} = s_H \cdot t_\beta(5) = 0,0757\cdot 2,78 \approx 0,2104$$

$$\Delta H_\delta = \frac{\delta}{3}\cdot t_\beta(\infty) = \frac{1}{3000}\cdot 1,96 \approx 6,53\cdot 10^{-4}$$

$$\Delta H = \sqrt{0,2104^2 + (6,53\cdot 10^{-4})^2} \approx 0,2104$$

$$\Delta v_{v+r} = \sqrt{\frac{10}{7}9,807}\frac{1}{2\sqrt{0,451}}\cdot 0,2104 \approx 0,5863\ (\mathrm{m/s})$$

$$\boxed{v_{v+r} = 2,4762 \pm 0,5863\ (\mathrm{m/s})}$$

b) Teorētiskais lodītes kustības ātrums, neievērojot lodītes rotāciju

$$v_v = \sqrt{2gH}$$

$$\Delta v_v = \frac{\partial v_v}{\partial H} \cdot \Delta H$$

$$\frac{\partial v_v}{\partial H} = \sqrt{0,5\frac{g}{\overline{H}}}$$

$$\Delta v_v = \sqrt{0,5\frac{9,807}{0,451}} \cdot 0,2104 \approx 0,6938 \text{ (m/s)}$$

$$\boxed{v_v = 2,9299 \pm 0,6938 \text{ (m/s)}}$$

$$e_v = \frac{v}{\overline{v}}$$

$\varepsilon(v_{l,1})$	$\varepsilon(v_{l,2})$	$\varepsilon(v_{l,3})$	$\varepsilon(v_{l,4})$	$\varepsilon(v_{l,5})$	$\varepsilon(v_{v+r})$	$\varepsilon(v_v)$
$0,1428$	$0,1532$	$0,1708$	$0,2011$	$0,2584$	$0,2367729$	$0,2368004$