# Kļūdu aprēķini

## Eksperimentālo ātrumu kļūdas

$$egin{aligned} \Delta v_{l,n} &= \sqrt{\left(rac{\partial v_{l,n}}{\partial m_r} \cdot \Delta m_r
ight)^2 + \left(rac{\partial v_{l,n}}{\partial m_l} \cdot \Delta m_l
ight)^2 + \left(rac{\partial v_{l,n}}{\partial \overline{s}_n} \cdot \Delta \overline{s}_n
ight)^2 + \left(rac{\partial v_{l,n}}{\partial l} \cdot \Delta l
ight)^2} \ rac{\partial v_{l,n}}{\partial m_r} &= rac{1}{m_l} \overline{s}_n \sqrt{rac{g}{l}} \ rac{\partial v_{l,n}}{\partial m_l} &= -rac{m_r}{m_l^2} \cdot \overline{s}_n \sqrt{rac{g}{l}} \ rac{\partial v_{l,n}}{\partial \overline{s}_n} &= \left(1 + rac{m_r}{m_l}
ight) \sqrt{rac{g}{l}} \ rac{\partial v_{l,n}}{\partial l} &= \left(1 + rac{m_r}{m_l}
ight) \cdot \overline{s}_n rac{\sqrt{g}}{-2l^{1,5}} \end{aligned}$$

	$rac{\partial v_{l,n}}{\partial m_r}$	$rac{\partial v_{l,n}}{\partial m_l}$	$rac{\partial v_{l,n}}{\partial \overline{s}_n}$	$rac{\partial v_{l,n}}{\partial l}$	$\Delta v_{l,n}, { m cm}$	$v_{l,n},\mathrm{cm}$
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

$$egin{aligned} v_{v+r} &= \sqrt{rac{10}{7}gH} \ \Delta v_{v+r} &= rac{\partial v_{v+r}}{\partial H} \cdot \Delta H \ rac{\partial v_{v+r}}{\partial H} &= \sqrt{rac{10}{7}g} \cdot rac{1}{2\sqrt{\overline{H}}} \ \Delta H &= \sqrt{\Delta H_{
m gad.}^2 + \Delta H_{\delta}^2} \ \Delta H_{
m gad.} &= s_H \cdot t_{eta}(5) = 0,0757 \cdot 2,78 pprox 0,2104 \ \Delta H_{\delta} &= rac{\delta}{3} \cdot t_{eta}(\infty) = rac{1}{3000} \cdot 1,96 pprox 6,53 \cdot 10^{-4} \ \Delta H &= \sqrt{0,2104^2 + (6,53 \cdot 10^{-4})^2} pprox 0,2104 \ \Delta v_{v+r} &= \sqrt{rac{10}{7}9,807} rac{1}{2\sqrt{0,451}} \cdot 0,2104 pprox 0,5863 \ ({
m m/s}) \ \hline v_{v+r} &= 2,4762 \pm 0,5863 \ ({
m m/s}) \ \hline \end{aligned}$$

# b) Teorētiskais lodītes kustības ātrums, neievērojot lodītes rotāciju

$$egin{aligned} v_v &= \sqrt{2gH} \ \Delta v_v &= rac{\partial v_v}{\partial H} \cdot \Delta H \ rac{\partial v_v}{\partial H} &= \sqrt{0,5rac{g}{\overline{H}}} \ \Delta v_v &= \sqrt{0,5rac{9,807}{0,451}} \cdot 0,2104 pprox 0,6938 ext{ (m/s)} \ v_v &= 2,9299 \pm 0,6938 ext{ (m/s)} \end{aligned}$$

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

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