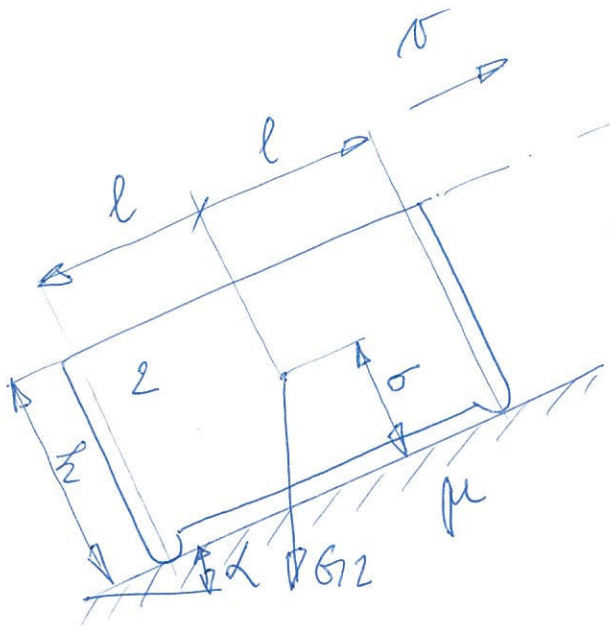
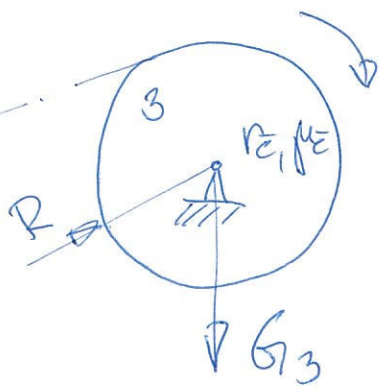




D:

M $\alpha = 30°$

$G_2 = 2000\,N$

$G_3 = 300\,N$

$r_č = 20\,mm$

$\mu_č = 0{,}2$

$\mu = 0{,}4$

$R = 200\,mm$

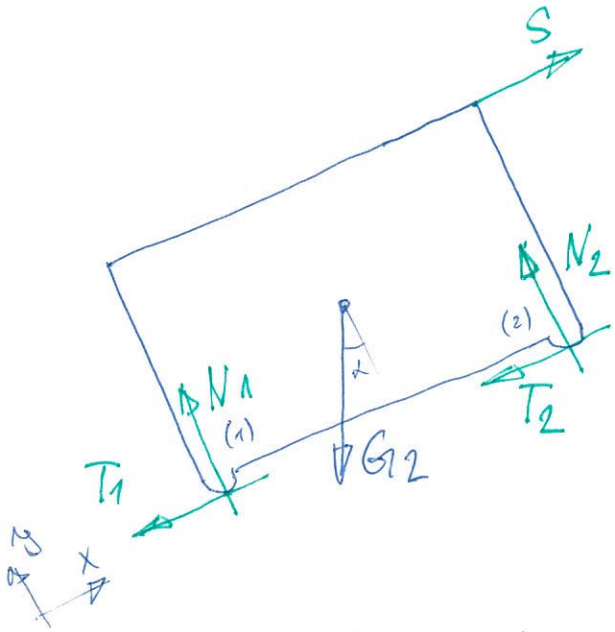
$l = 0{,}5\,m$

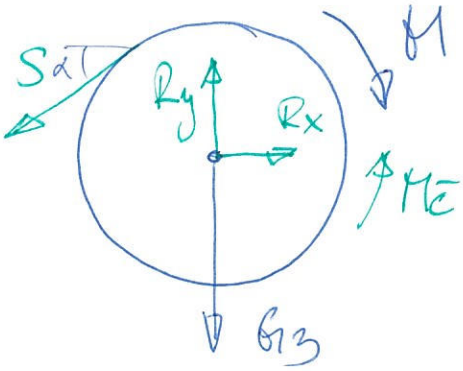
$h = 0{,}3\,m$

$b = 200\,mm$

Q: • M pro $v = konst.$

• h_{max} (klopení tělesa 2)





x: $S - T_1 - T_2 - G_2 \sin\alpha = 0$

y: $N_1 + N_2 - G_2 \cos\alpha = 0$

M(1): $N_2 \cdot 2l - S \cdot h - G_2 \cdot \cos\alpha \cdot l + G_2 \sin\alpha \cdot b = 0$

$T_1 = |N_1| \cdot \mu$

$T_2 = |N_2| \cdot \mu$

x: $R_x - S \cdot \cos\alpha = 0$

y: $R_y - G_3 - S \cdot \sin\alpha = 0$

M: $S \cdot R - M + M_č = 0$

$M_č = r_č \cdot \mu_č \sqrt{R_x^2 + R_y^2}$

$R_y > R_x$ (předpoklad)

$M_č = r_č \cdot \mu_č (0{,}96 R_y + 0{,}4 R_x)$

→ a naopak

Neznámé:

$$[S \quad T_1 \quad T_2 \quad N_1 \quad N_2 \quad H \quad H_č \quad R_x \quad R_y]$$

$$\begin{bmatrix}
1 & -1 & -1 & & & & & & \\
 & & & 1 & 1 & & & & \\
-h & & & & 2l & & & & \\
 & 1 & & -\mu & & & & & \\
 & & 1 & & -\mu & & & & \\
-c\alpha & & & & & & & 1 & \\
-s\alpha & & & & & & & & 1 \\
R & & & & & -1 & 1 & & \\
 & & & & & & 1 & -0{,}96\,r\bar{e}\mu\bar{e} & -0{,}4\,r\bar{e}\mu\bar{e}
\end{bmatrix}
\begin{bmatrix} S \\ T_1 \\ T_2 \\ N_1 \\ N_2 \\ H \\ H_č \\ R_x \\ R_y \end{bmatrix}
=
\begin{bmatrix} G_2 s\alpha \\ G_2 c\alpha \\ G_{2c\alpha}\cdot l \\ -G_{2s\alpha}\,b \\ \varnothing \\ \varnothing \\ \varnothing \\ G_3 \\ \varnothing \\ \varnothing \end{bmatrix}$$

Klopení

$N_1 = 0$

$N_1 + N_2 - G_2 \cos\alpha = 0 \rightarrow N_1 + N_2 = G_2 \cos\alpha$

$N_2 \cdot 2l - S \cdot h - G_2 \cos\alpha \cdot l + G_2 \sin\alpha \cdot b = 0$

$S - T_1 - T_2 - G_2 \sin\alpha = 0$

$T_1 = |N_1| \mu$

$T_2 = |N_2| \mu$

$\rightarrow S - (N_1 + N_2)\mu - G_2 \sin\alpha = 0$

$S = G_2 \sin\alpha + G_2 \cdot \mu \cdot \cos\alpha$

$N_2 \cdot 2l - S \cdot h - G_2 \cos\alpha \cdot l + G_2 \sin\alpha \cdot b = 0$

$\uparrow N_1 + N_2 = G_2 \cos\alpha \Rightarrow N_2 = G_2 \cos\alpha$

($N_1 = 0$)

$G_2 \cdot 2l \cos\alpha - [G_2 \sin\alpha + G_2 \mu \cos\alpha] h - G_2 \cos\alpha \cdot l + G_2 \sin\alpha \cdot b = 0$

$$h_{max} = \frac{G_2 \sin\alpha \cdot b + G_2 \cos\alpha \cdot l}{G_2 \sin\alpha \cdot + G_2 \cos\alpha \cdot \mu} = \frac{b \cdot \sin\alpha + l \cdot \cos\alpha}{\sin\alpha + \mu \cos\alpha}$$

```
%reseni ulohy s pasivnimi odpory
clear all, close all, clc;

alpha=30*pi/180;
G2=2000;
G3=300;
rc=0.02;
muc=0.2;
mu=0.4;
R=0.2;
l=0.5;
h=0.3;
b=0.2;

disp('Maximalni vyska telesa - mez klopeni');
h_max=(b*sin(alpha)+l*cos(alpha))/(sin(alpha)+mu*cos(alpha))


A=[1 -1 -1 0 0 0 0 0 0;
   0 0 0 1 1 0 0 0 0;
   -h 0 0 0 2*l 0 0 0 0;
   0 1 0 -mu 0 0 0 0 0;
   0 0 1 0 -mu 0 0 0 0;
   -cos(alpha) 0 0 0 0 0 0 1 0;
   -sin(alpha) 0 0 0 0 0 0 0 1;
   R 0 0 0 0 -1 1 0 0;
   0 0 0 0 0 0 1 -0.96*rc*muc -0.4*rc*muc]; %linearizace pro↙
Rx>Ry

b=[G2*sin(alpha) G2*cos(alpha) G2*l*cos(alpha)-G2*b*sin↙
(alpha) 0 0 0 G3 0 0]';

r=inv(A)*b;

disp('Reakce - pro urceni linearizovaneho momentu cepoveho↙
treni => Ponceletova vztahu');
Rx=r(8)
Ry=r(9)
```

```
disp('Moment pro rovnomerny nezrychleny pohyb');
M=r(6)

%%% VYSLEDKY
% Maximalni vyska telesa - mez klopeni
% h_max =
%    0.629733344574863
% Reakce - pro urceni linearizovaneho momentu cepoveho treni
=> Ponceletova vztahu
% Rx =
%     1.466025403784439e+003
% Ry =
%     1.146410161513775e+003
% Moment pro rovnovahu
% M =
%     3.460278584144645e+002
```