Sofia Braun

Estudo do rolamento de um cilindro numa superfície horizontal

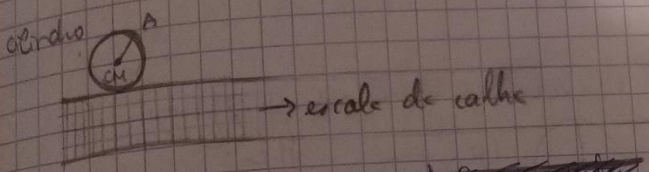
Insuf ??

Objetivos:

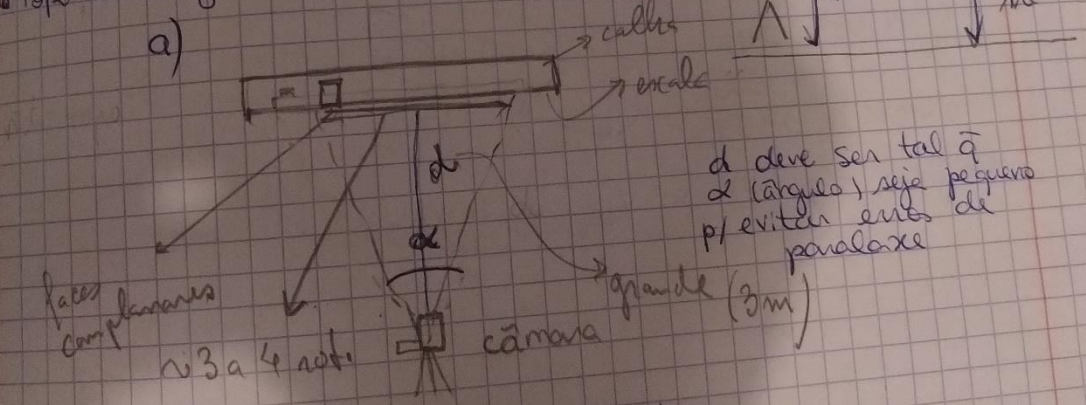
- Verificar: → princípio da sobreposição no momento em cont
  → condição de rolamento sem escorregamento ($v_{cm} = \omega R$, c/ $v_{cm} = 2\pi/T$)
- Mostrar que: → ponto de contacto do cilindro c/ superfície tem velocidade nula
  → ponto no topo tem velocidade máx = $= 2 v_{cm}$.
- Familiarização c/ técnicas de processamento de vídeo e imagens.

Montagem:

- Frontal - cilindro/calha:



- Topo ~~[illegible]~~



d deve ser tal q α (ângulo) seja pequeno p/ evitar erros de paralaxe

Material - medição diâmetro cilindro:

Craveira Mitutoyo

- diâmetro cilindro → $d = 66,50 \text{ mm} \pm 0,01 \text{ mm}$

Garantir q é possível visualizar 3 a 4 rotações do cilindro na gravação.

M/S → completar esq. ep

massa_A					
t	x	y	v	r	vel angula
1.12E+00	2.39E+15	-3.33E+15	2.35E+16	4.09E+15	3.53E+14
9.60E-01	5.29E+15	-1.47E+15	1.76E+16	5.49E+15	2.64E+14
1.28E+00	-5.17E+14	-6.24E+15	2.75E+16	6.26E+15	4.14E+14
8.00E-01	7.27E+15	-5.44E+14	1.14E+16	7.29E+15	1.72E+14
1.60E-01	8.46E+15	1.19E+14	NaN	8.46E+15	#VALUE!
3.20E-01	8.46E+15	1.19E+14	0.00E+00	8.46E+15	0.00E+00
4.80E-01	8.46E+15	1.19E+14	4.13E+14	8.46E+15	6.21E+12
6.40E-01	8.59E+15	1.19E+14	4.25E+15	8.59E+15	6.39E+13
1.44E+00	-3.28E+15	-1.01E+16	3.00E+16	1.06E+16	4.51E+14
1.60E+00	-5.52E+15	-1.44E+16	3.17E+16	1.55E+16	4.77E+14
1.76E+00	-6.84E+15	-1.96E+16	3.31E+16	2.07E+16	4.98E+14
1.92E+00	-7.36E+15	-2.49E+16	3.26E+16	2.59E+16	4.91E+14
2.08E+00	-7.22E+15	-3.00E+16	3.36E+16	3.09E+16	5.06E+14
2.24E+00	-6.15E+15	-3.56E+16	3.27E+16	3.61E+16	4.92E+14
2.40E+00	-4.69E+15	-4.02E+16	3.10E+16	4.05E+16	4.67E+14
2.56E+00	-1.91E+15	-4.45E+16	2.85E+16	4.46E+16	4.29E+14
2.72E+00	4.73E+14	-4.77E+16	2.43E+16	4.77E+16	3.65E+14
2.88E+00	3.25E+15	-5.04E+16	2.06E+16	5.05E+16	3.09E+14
3.04E+00	5.63E+15	-5.18E+16	1.57E+16	5.21E+16	2.36E+14
3.20E+00	7.61E+15	-5.29E+16	1.04E+16	5.34E+16	1.56E+14
3.36E+00	8.67E+15	-5.31E+16	6.53E+15	5.38E+16	9.82E+13
3.52E+00	9.60E+15	-5.35E+16	3.69E+15	5.44E+16	5.55E+13
3.68E+00	9.73E+15	-5.36E+16	2.06E+15	5.45E+16	3.10E+13
3.84E+00	9.07E+15	-5.39E+16	6.53E+15	5.47E+16	9.82E+13
4.00E+00	8.01E+15	-5.48E+16	1.03E+16	5.54E+16	1.56E+14
4.16E+00	6.17E+15	-5.55E+16	1.50E+16	5.58E+16	2.26E+14
4.32E+00	3.92E+15	-5.74E+16	1.73E+16	5.75E+16	2.61E+14
4.48E+00	1.81E+15	-5.89E+16	1.96E+16	5.90E+16	2.94E+14
4.64E+00	-6.94E+14	-6.16E+16	2.36E+16	6.16E+16	3.55E+14
4.80E+00	-2.67E+15	-6.50E+16	2.46E+16	6.51E+16	3.69E+14
4.96E+00	-4.25E+15	-6.86E+16	2.64E+16	6.87E+16	3.97E+14
5.12E+00	-5.56E+15	-7.30E+16	2.83E+16	7.32E+16	4.26E+14
5.28E+00	-6.22E+15	-7.74E+16	2.82E+16	7.77E+16	4.24E+14
5.44E+00	-6.34E+15	-8.19E+16	2.77E+16	8.22E+16	4.16E+14
5.60E+00	-5.81E+15	-8.63E+16	2.75E+16	8.65E+16	4.14E+14
5.76E+00	-5.14E+15	-9.07E+16	2.77E+16	9.08E+16	4.17E+14
5.92E+00	-3.55E+15	-9.49E+16	2.57E+16	9.49E+16	3.86E+14
6.08E+00	-1.83E+15	-9.82E+16	2.28E+16	9.82E+16	3.43E+14
6.24E+00	2.92E+14	-1.01E+17	2.28E+16	1.01E+17	3.43E+14
6.40E+00	3.07E+15	-1.04E+17	2.02E+16	1.04E+17	3.04E+14
6.56E+00	5.32E+15	-1.05E+17	1.58E+16	1.05E+17	2.37E+14
6.72E+00	6.77E+15	-1.07E+17	1.21E+16	1.07E+17	1.83E+14
6.88E+00	8.49E+15	-1.07E+17	9.98E+15	1.08E+17	1.50E+14
7.52E+00	9.42E+15	-1.08E+17	7.21E+15	1.08E+17	1.08E+14
7.84E+00	5.85E+15	-1.08E+17	NaN	1.09E+17	#VALUE!
7.20E+00	1.05E+16	-1.08E+17	3.33E+15	1.09E+17	5.00E+13
7.36E+00	1.07E+16	-1.08E+17	3.40E+15	1.09E+17	5.12E+13
7.04E+00	9.68E+15	-1.08E+17	6.67E+15	1.09E+17	1.00E+14
7.68E+00	8.49E+15	-1.09E+17	1.13E+16	1.09E+17	1.69E+14

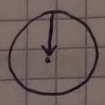
massa_cm					
t	x	y	v	v (aj lin)	resídos
1.60E-01	1.24E+14	-3.69E+14	7.74E+14	5.38E+28	5.38E+28
6.40E-01	3.73E+14	-2.22E+15	5.83E+14	1.62E+29	1.62E+29
1.12E+00	5.11E+14	-1.15E+16	4.56E+14	2.22E+29	2.22E+29
1.60E+00	6.48E+14	-2.05E+16	4.05E+14	2.82E+29	2.82E+29
2.08E+00	1.03E+15	-2.83E+16	4.95E+14	4.48E+29	4.48E+29

Critérios	1	2	3	4			
Visibilidade dos pontos CM, A e escala	✓	✓	✓	✓	✓	✓	✓
Trajetória e escala complanares	Mt Boa	mt boa	Boa	Mau Boa	Mau Boa	Mt Boa	Boa
Nº pontos/ rotação (14-19)	2 rot	2 rot	2 rot	2 rot	2 rot	2 rot	

Sendo ✓ a velocidade do cilindro:
✓↑ ⇒ poucos dados por rotação
✓↓ ⇒ v_{CM} não constante

Proc. Obtenção - AE escolhido: 1/500

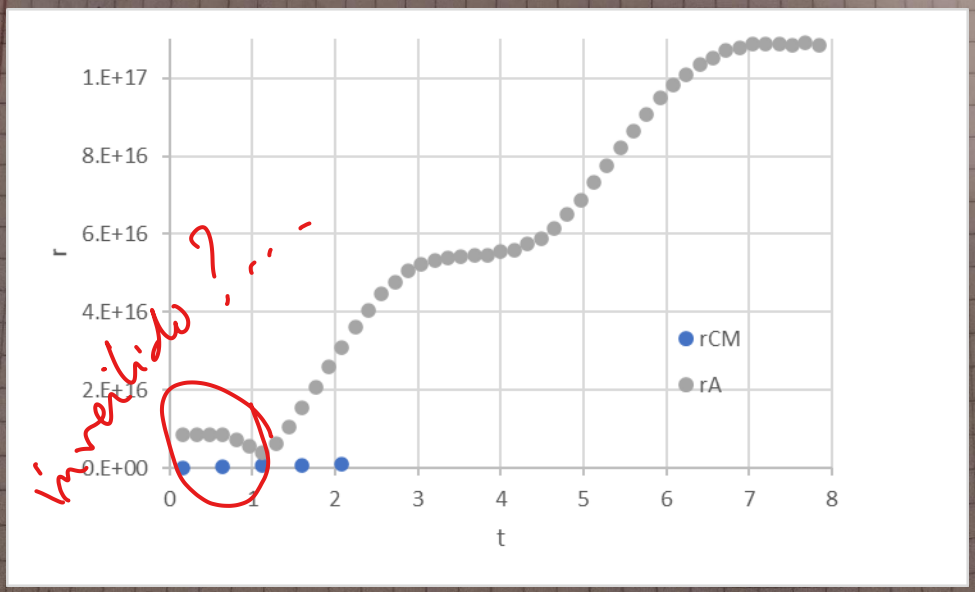
⚠ Escolher lado do cilindro em que o centro é mais legível:



(o ā tem uma seta)

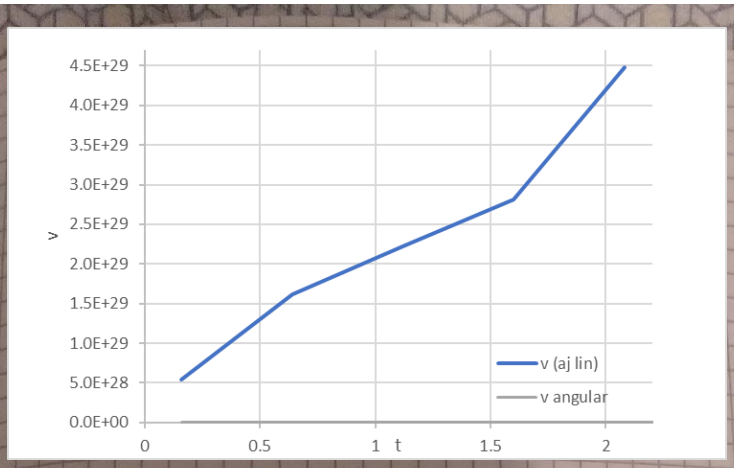
0414 0415 0416 0417 × 0418 ✓ 0419 ± ×
× ± × ×

0410 ✓ 0409 ✓ 0408 ✓



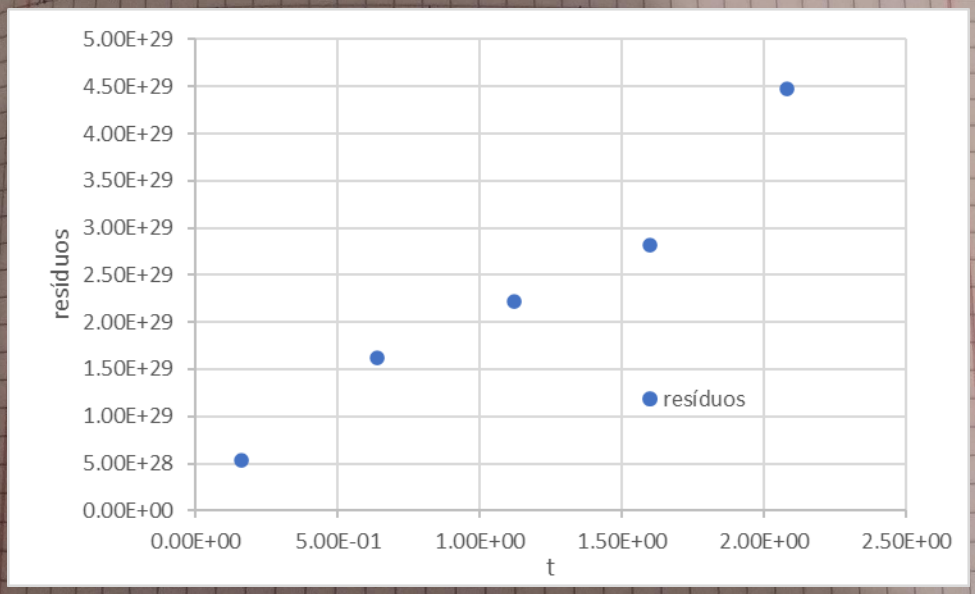
inválido ?...

Não registaram os dados de 3 a 4 rotações? O que apresentam aqui não pode estar bom → leram mal no tracker?



$m \simeq 4,3 \times 10^{14}$
$S_m \simeq 5 \times 10^{13}$
$r^2 \simeq 0,96$

$b = 5 \times 10^{13}$
$S_b \simeq 7 \times 10^{13}$
$S_y \simeq 8 \times 10^{13}$



Pela análise dos dados verificamos que o ajuste linear apresenta resíduos pouco dispersos, logo é um mau ajuste. Isto pode-se dever ao funcionamento do tracker.

Observamos que os valores, excepto os de posição do centro de massa não são os esperados.

Não consegui obter os resultados esperados pois dada a dificuldade do uso do tracker