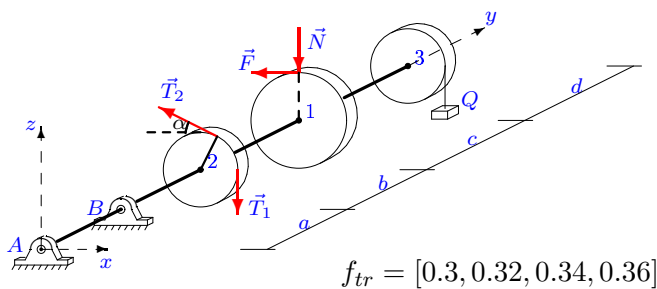


Вал

Горизонтальный вал весом G может вращаться в цилиндрических шарнирах A и B . К шкиву 1 приложено нормальное давление N и касательная сила сопротивления F , пропорциональная N . На шкив 2 действуют силы натяжения ремней T_1 и T_2 . Груз Q висит на нити, навитой на шкив 3. Найти математические ожидания реакции шарниров в условии равновесия вала, если коэффициент трения f задан как случайная величина с рядом распределения $p = [0.2, 0.3, 0.4, 0.1]$. Учесть веса шкивов P_1, P_2, P_3 . Все нагрузки действуют в вертикальной плоскости. Силы даны в ньютонах, размеры — в сантиметрах.

Кирсанов М.Н. **Решебник. Теоретическая механика** / Под ред. А. И. Кириллова. — М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.94.)

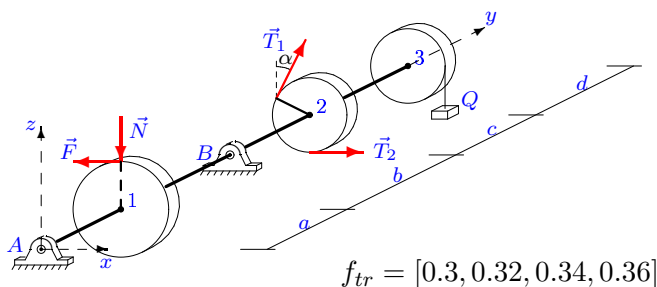
Задача L-22.1.



$$F = fN, T_1 = 30, \\ T_2 = 18, P_1 = 32, \\ P_2 = 20, P_3 = 28, \\ Q = 10, G = 15, \\ \alpha = 45^\circ, R_1 = 20, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 25, \\ c = 27, d = 26.$$

2

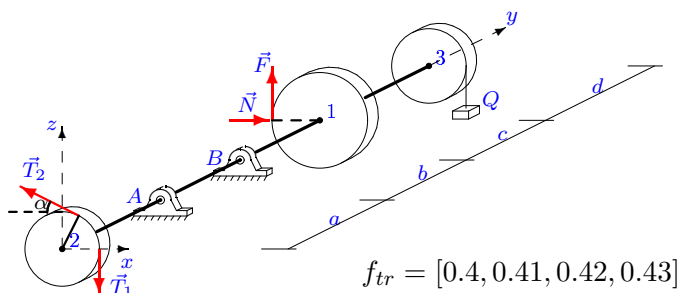
Задача L-22.2.



$$F = fN, T_1 = 30, \\ T_2 = 18, P_1 = 36, \\ P_2 = 20, P_3 = 28, \\ Q = 26, G = 15, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 29, \\ c = 31, d = 28.$$

2

Задача L-22.3.

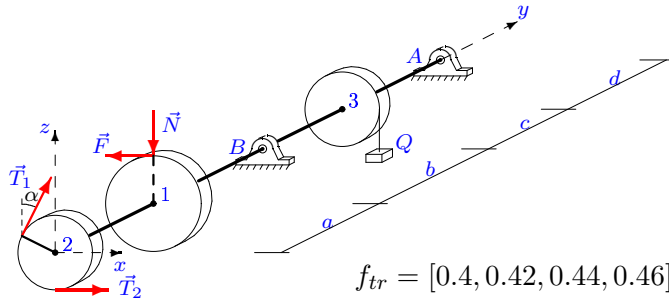


$$F = fN, T_1 = 50, \\ T_2 = 96, P_1 = 30, \\ P_2 = 20, P_3 = 28, \\ Q = 22, G = 25, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 28, \\ c = 30, d = 25.$$

2

Задача L-22.4.

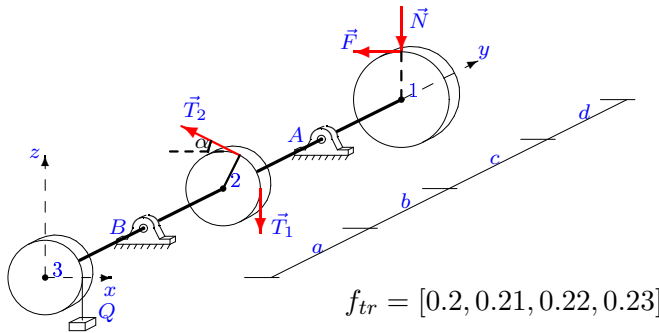
2



$F = fN, T_1 = 50,$
 $T_2 = 29, P_1 = 34,$
 $P_2 = 20, P_3 = 28,$
 $Q = 10, G = 25,$
 $\alpha = 45^\circ, R_1 = 24,$
 $R_2 = 10, R_3 = 12,$
 $a = 24, b = 25,$
 $c = 27, d = 27.$

Задача L-22.5.

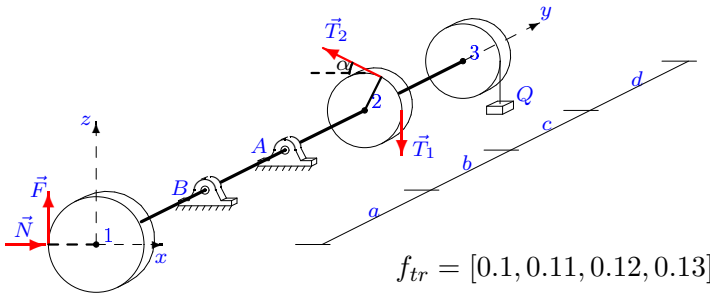
2



$F = fN, T_1 = 70,$
 $T_2 = 37, P_1 = 28,$
 $P_2 = 20, P_3 = 24,$
 $Q = 26, G = 35,$
 $\alpha = 45^\circ, R_1 = 20,$
 $R_2 = 10, R_3 = 11,$
 $a = 22, b = 27,$
 $c = 29, d = 24.$

Задача L-22.6.

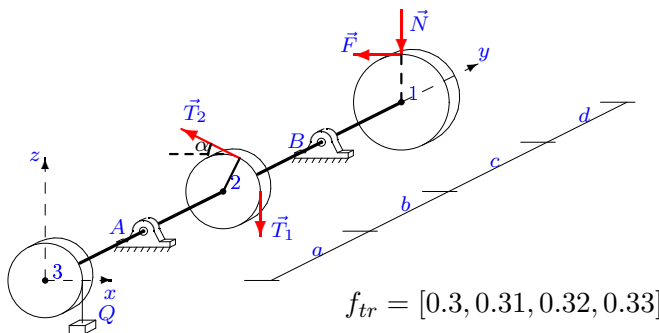
2



$F = fN, T_1 = 60,$
 $T_2 = 117, P_1 = 18,$
 $P_2 = 10, P_3 = 14,$
 $Q = 18, G = 30,$
 $\alpha = 30^\circ, R_1 = 18,$
 $R_2 = 8, R_3 = 9,$
 $a = 22, b = 25,$
 $c = 26, d = 24.$

Задача L-22.7.

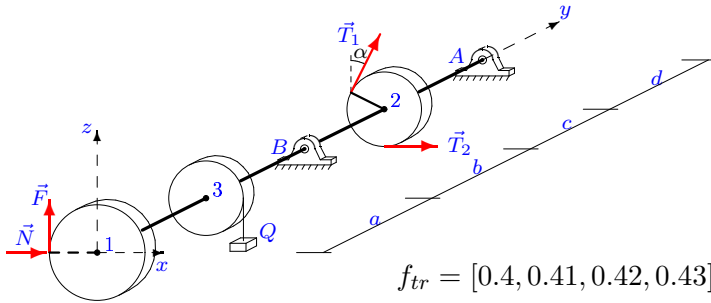
2



$F = fN, T_1 = 70,$
 $T_2 = 38, P_1 = 40,$
 $P_2 = 30, P_3 = 38,$
 $Q = 26, G = 35,$
 $\alpha = 60^\circ, R_1 = 18,$
 $R_2 = 12, R_3 = 14,$
 $a = 24, b = 29,$
 $c = 32, d = 25.$

Задача L-22.8.

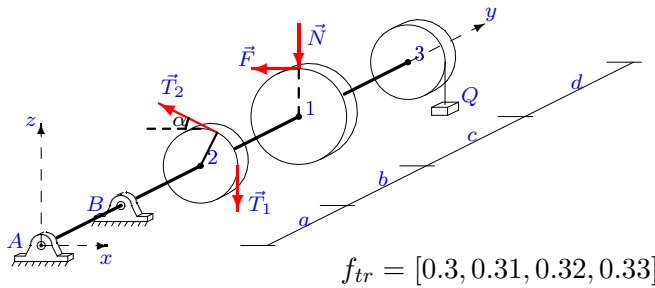
2



$$F = fN, T_1 = 60, \\ T_2 = 117, P_1 = 36, \\ P_2 = 20, P_3 = 28, \\ Q = 18, G = 30, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 27, \\ c = 29, d = 28.$$

Задача L-22.9.

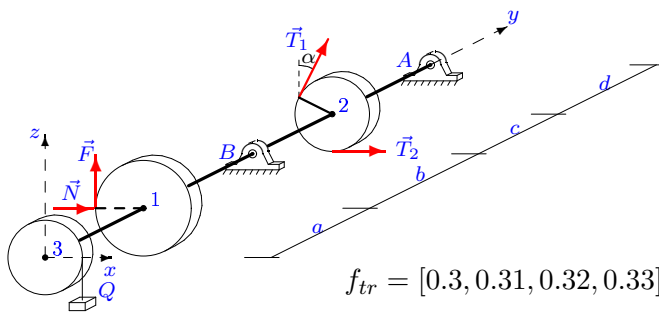
2



$$F = fN, T_1 = 30, \\ T_2 = 18, P_1 = 32, \\ P_2 = 20, P_3 = 28, \\ Q = 26, G = 15, \\ \alpha = 45^\circ, R_1 = 20, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 29, \\ c = 31, d = 26.$$

Задача L-22.10.

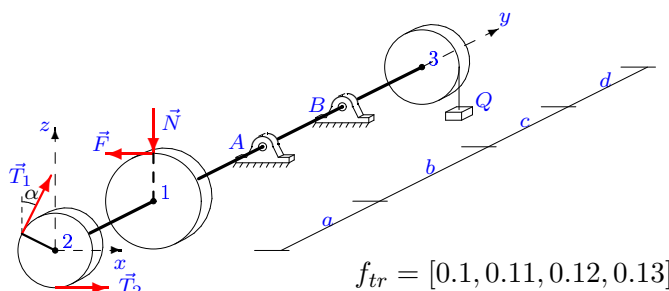
2



$$F = fN, T_1 = 70, \\ T_2 = 137, P_1 = 36, \\ P_2 = 20, P_3 = 28, \\ Q = 18, G = 35, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 27, \\ c = 29, d = 28.$$

Задача L-22.11.

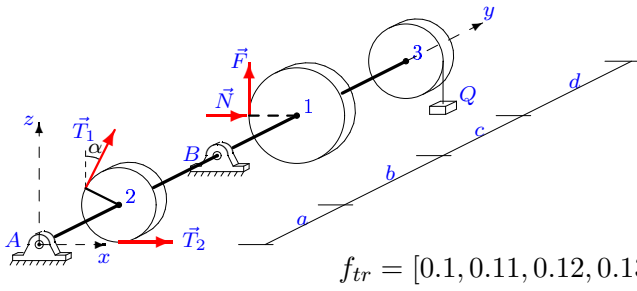
2



$$F = fN, T_1 = 50, \\ T_2 = 26, P_1 = 22, \\ P_2 = 10, P_3 = 14, \\ Q = 10, G = 25, \\ \alpha = 30^\circ, R_1 = 26, \\ R_2 = 8, R_3 = 9, \\ a = 22, b = 23, \\ c = 24, d = 26.$$

Задача L-22.12.

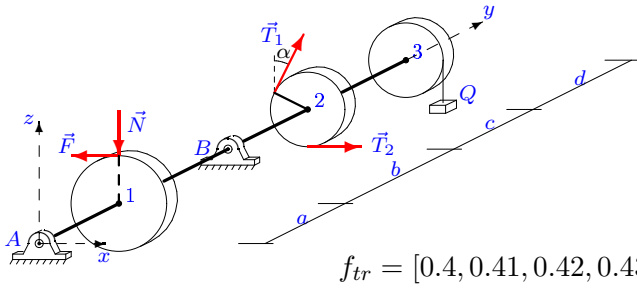
2



$F = fN, T_1 = 30,$
 $T_2 = 57, P_1 = 20,$
 $P_2 = 10, P_3 = 14,$
 $Q = 18, G = 15,$
 $\alpha = 30^\circ, R_1 = 22,$
 $R_2 = 8, R_3 = 9,$
 $a = 22, b = 25,$
 $c = 26, d = 25.$

Задача L-22.13.

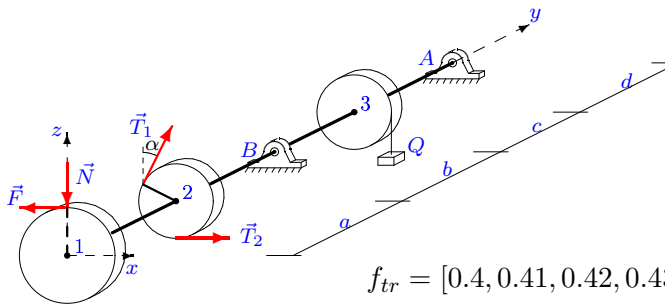
2



$F = fN, T_1 = 30,$
 $T_2 = 19, P_1 = 26,$
 $P_2 = 10, P_3 = 18,$
 $Q = 26, G = 15,$
 $\alpha = 30^\circ, R_1 = 26,$
 $R_2 = 8, R_3 = 10,$
 $a = 24, b = 29,$
 $c = 30, d = 28.$

Задача L-22.14.

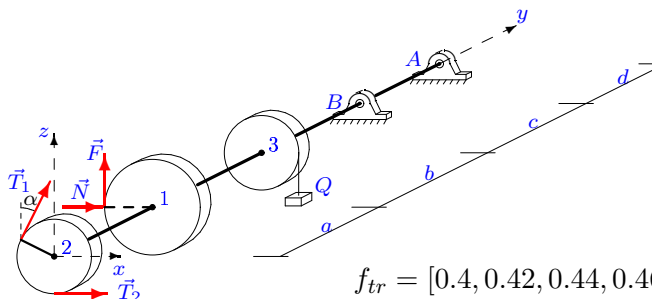
2



$F = fN, T_1 = 60,$
 $T_2 = 34, P_1 = 34,$
 $P_2 = 20, P_3 = 28,$
 $Q = 10, G = 30,$
 $\alpha = 45^\circ, R_1 = 24,$
 $R_2 = 10, R_3 = 12,$
 $a = 24, b = 25,$
 $c = 27, d = 27.$

Задача L-22.15.

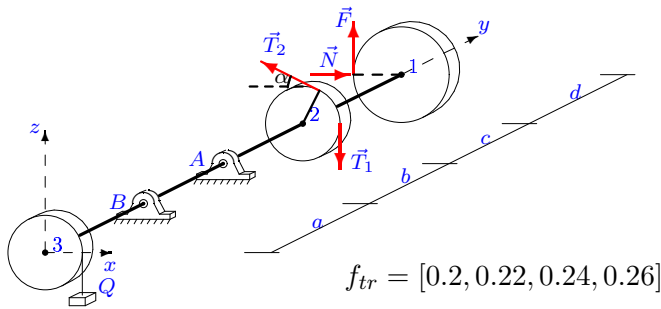
2



$F = fN, T_1 = 50,$
 $T_2 = 98, P_1 = 44,$
 $P_2 = 30, P_3 = 38,$
 $Q = 14, G = 25,$
 $\alpha = 60^\circ, R_1 = 26,$
 $R_2 = 12, R_3 = 14,$
 $a = 24, b = 26,$
 $c = 29, d = 27.$

Задача L-22.16.

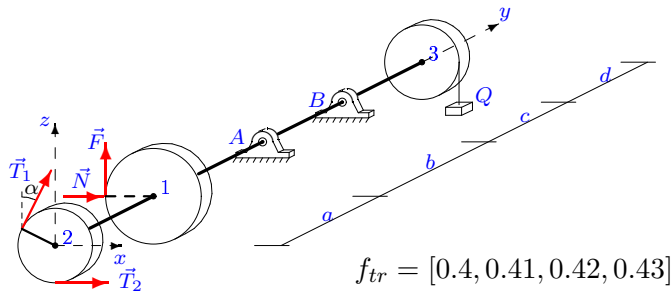
2



$$F = fN, T_1 = 70, \\ T_2 = 138, P_1 = 18, \\ P_2 = 10, P_3 = 14, \\ Q = 14, G = 35, \\ \alpha = 30^\circ, R_1 = 18, \\ R_2 = 8, R_3 = 9, \\ a = 22, b = 24, \\ c = 25, d = 24.$$

Задача L-22.17.

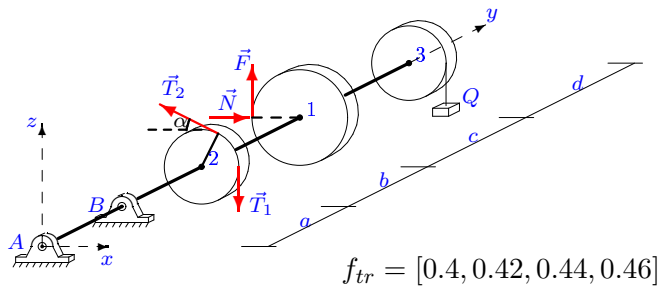
2



$$F = fN, T_1 = 50, \\ T_2 = 98, P_1 = 24, \\ P_2 = 10, P_3 = 18, \\ Q = 14, G = 25, \\ \alpha = 30^\circ, R_1 = 22, \\ R_2 = 8, R_3 = 10, \\ a = 24, b = 26, \\ c = 27, d = 27.$$

Задача L-22.18.

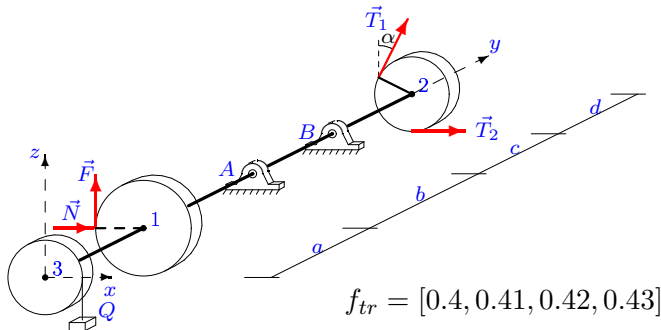
2



$$F = fN, T_1 = 30, \\ T_2 = 57, P_1 = 30, \\ P_2 = 20, P_3 = 28, \\ Q = 22, G = 15, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 28, \\ c = 30, d = 25.$$

Задача L-22.19.

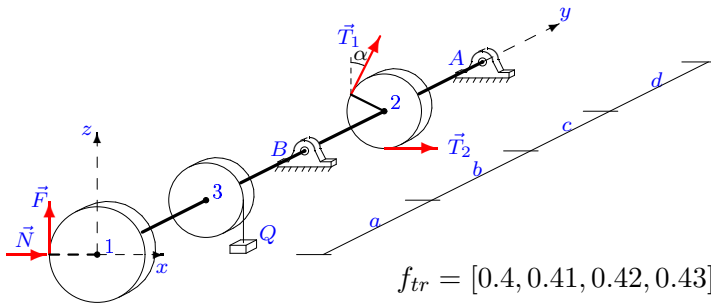
2



$$F = fN, T_1 = 70, \\ T_2 = 137, P_1 = 26, \\ P_2 = 10, P_3 = 18, \\ Q = 18, G = 35, \\ \alpha = 30^\circ, R_1 = 26, \\ R_2 = 8, R_3 = 10, \\ a = 24, b = 27, \\ c = 28, d = 28.$$

Задача L-22.20.

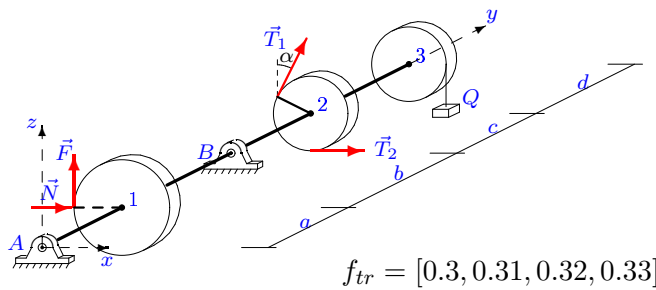
2



$$F = fN, T_1 = 60, \\ T_2 = 116, P_1 = 36, \\ P_2 = 20, P_3 = 28, \\ Q = 22, G = 30, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 28, \\ c = 30, d = 28.$$

Задача L-22.21.

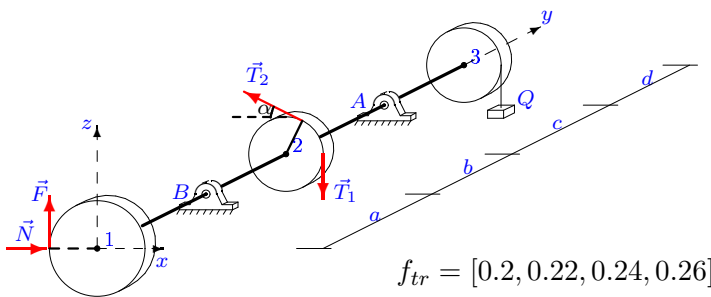
2



$$F = fN, T_1 = 30, \\ T_2 = 57, P_1 = 36, \\ P_2 = 20, P_3 = 28, \\ Q = 18, G = 15, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 27, \\ c = 29, d = 28.$$

Задача L-22.22.

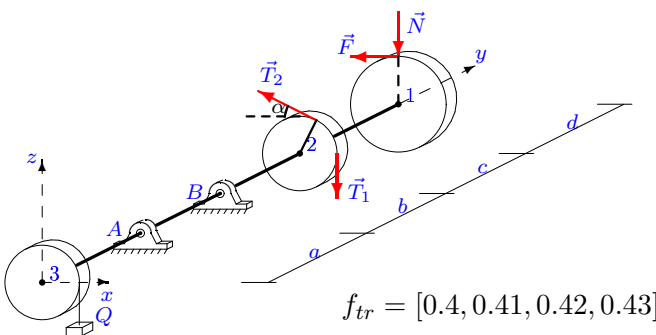
2



$$F = fN, T_1 = 60, \\ T_2 = 116, P_1 = 28, \\ P_2 = 20, P_3 = 24, \\ Q = 22, G = 30, \\ \alpha = 45^\circ, R_1 = 20, \\ R_2 = 10, R_3 = 11, \\ a = 22, b = 26, \\ c = 28, d = 24.$$

Задача L-22.23.

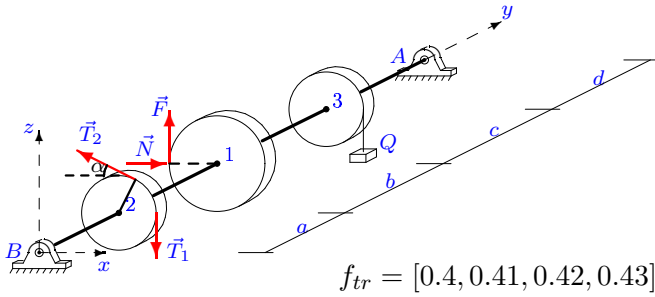
2



$$F = fN, T_1 = 70, \\ T_2 = 39, P_1 = 30, \\ P_2 = 20, P_3 = 28, \\ Q = 26, G = 35, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 29, \\ c = 31, d = 25.$$

Задача L-22.24.

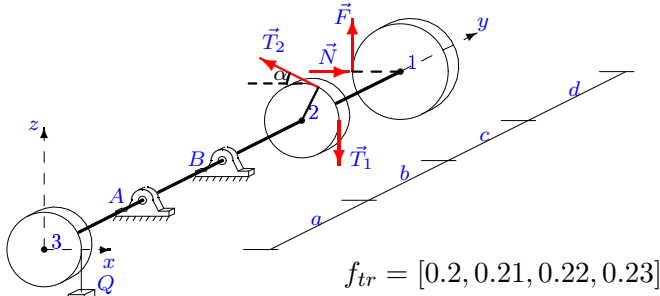
2



$F = fN, T_1 = 40,$
 $T_2 = 76, P_1 = 32,$
 $P_2 = 20, P_3 = 28,$
 $Q = 22, G = 20,$
 $\alpha = 45^\circ, R_1 = 20,$
 $R_2 = 10, R_3 = 12,$
 $a = 24, b = 28,$
 $c = 30, d = 26.$

Задача L-22.25.

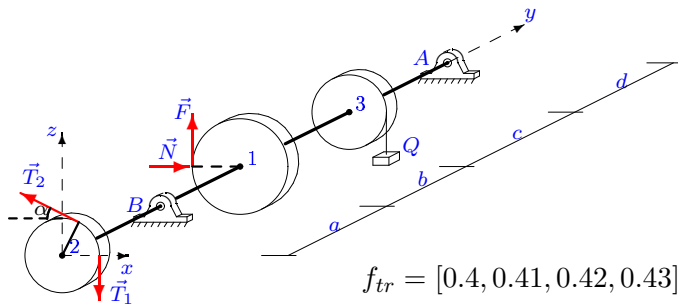
2



$F = fN, T_1 = 70,$
 $T_2 = 136, P_1 = 26,$
 $P_2 = 20, P_3 = 24,$
 $Q = 22, G = 35,$
 $\alpha = 45^\circ, R_1 = 16,$
 $R_2 = 10, R_3 = 11,$
 $a = 22, b = 26,$
 $c = 28, d = 23.$

Задача L-22.26.

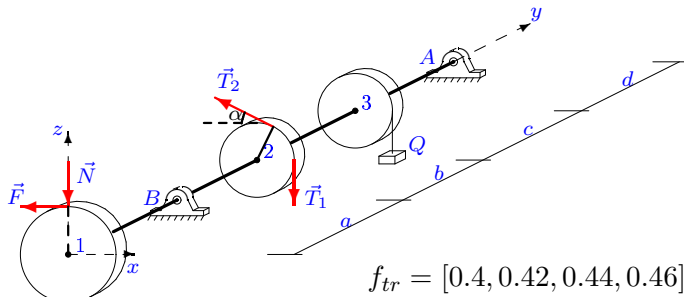
2



$F = fN, T_1 = 50,$
 $T_2 = 97, P_1 = 42,$
 $P_2 = 30, P_3 = 38,$
 $Q = 18, G = 25,$
 $\alpha = 60^\circ, R_1 = 22,$
 $R_2 = 12, R_3 = 14,$
 $a = 24, b = 27,$
 $c = 30, d = 26.$

Задача L-22.27.

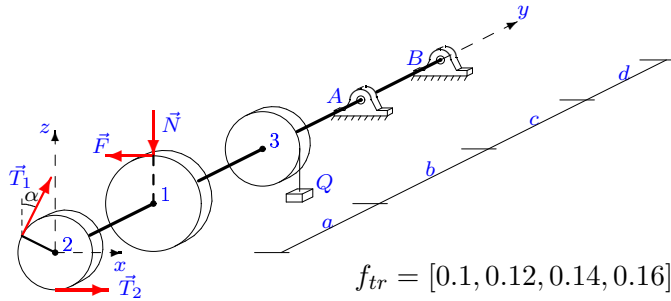
2



$F = fN, T_1 = 60,$
 $T_2 = 34, P_1 = 42,$
 $P_2 = 30, P_3 = 38,$
 $Q = 10, G = 30,$
 $\alpha = 60^\circ, R_1 = 22,$
 $R_2 = 12, R_3 = 14,$
 $a = 24, b = 25,$
 $c = 28, d = 26.$

Задача L-22.28.

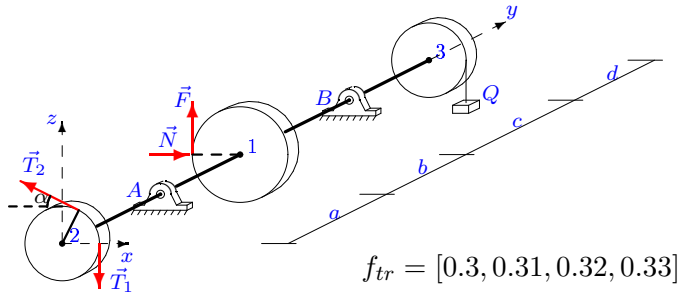
2



$$F = fN, T_1 = 50, \\ T_2 = 26, P_1 = 40, \\ P_2 = 30, P_3 = 34, \\ Q = 10, G = 25, \\ \alpha = 60^\circ, R_1 = 26, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 23, \\ c = 26, d = 25.$$

Задача L-22.29.

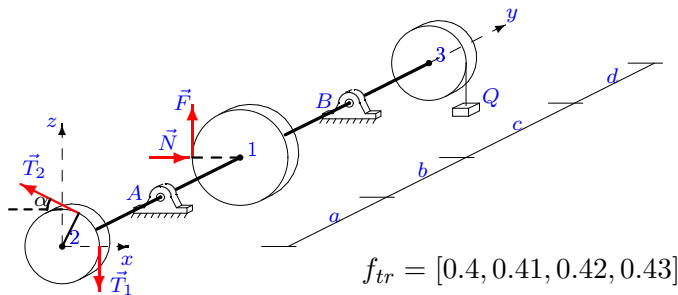
2



$$F = fN, T_1 = 50, \\ T_2 = 96, P_1 = 40, \\ P_2 = 30, P_3 = 38, \\ Q = 22, G = 25, \\ \alpha = 60^\circ, R_1 = 18, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 28, \\ c = 31, d = 25.$$

Задача L-22.30.

2



$$F = fN, T_1 = 50, \\ T_2 = 98, P_1 = 40, \\ P_2 = 30, P_3 = 38, \\ Q = 14, G = 25, \\ \alpha = 60^\circ, R_1 = 18, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 26, \\ c = 29, d = 25.$$

Отвѣты.

Вал

22-Jan-16

	N	X_A	Z_A	X_B	Z_B	$M(R_A)$	$M(R_B)$
1	33.333	-39.258	-320.756	63.986	476.361	330.393	491.211
2	42.857	31.378	-17.104	-55.163	163.748	34.691	174.650
3	28.488	156.590	-114.638	-117.196	209.506	195.034	241.197
4	29.891	52.031	4.512	-102.636	107.024	52.149	150.731
5	133.913	56.614	260.565	0.349	50.185	281.016	45.781
6	125.641	317.267	149.793	-341.583	-74.627	365.727	383.861
7	125.926	-7.064	73.586	67.619	258.431	71.261	276.050
8	29.402	-54.805	-52.519	-134.024	129.450	75.167	187.909
9	65.455	-69.380	-501.548	103.707	705.275	514.731	724.615
10	49.134	-71.611	-63.695	-164.021	134.984	94.942	215.340
11	83.432	-125.385	107.126	85.231	14.005	181.847	85.588
12	18.881	-27.853	-53.568	-63.028	102.133	59.686	122.370
13	31.127	26.569	-8.555	-47.184	108.701	27.718	119.007
14	36.822	21.015	-33.493	-81.608	149.888	40.656	173.086
15	31.773	478.159	-154.413	-651.233	265.798	507.204	710.251
16	89.316	-27.668	18.095	57.863	50.683	70.570	99.203
17	25.793	-401.408	-78.482	252.615	115.090	410.954	278.483
18	0.815	-44.228	-275.084	83.010	380.111	278.592	389.024
19	31.843	109.452	208.244	-313.295	-175.558	234.130	358.082
20	24.585	-59.903	-56.984	-123.108	139.986	82.055	187.631
21	5.844	41.380	-33.566	-125.438	127.425	53.158	178.906
22	61.154	64.408	76.096	-43.537	9.980	102.128	57.160
23	90.407	-104.548	-202.359	171.000	474.188	233.872	513.856
24	11.163	6.568	62.450	36.010	41.010	62.773	54.426
25	113.587	119.241	89.790	-136.662	-15.081	163.351	163.186
26	32.981	-24.753	57.551	40.272	47.263	62.816	61.533
27	44.664	-0.862	35.480	38.407	189.739	34.450	197.971
28	100.481	-218.529	572.783	165.305	-358.302	690.922	444.960
29	41.077	45.942	-3.656	-39.020	111.962	44.972	118.905
30	49.096	44.495	-8.400	-44.591	99.418	44.285	109.336

L-22 файл o22L2A