

Трение качения

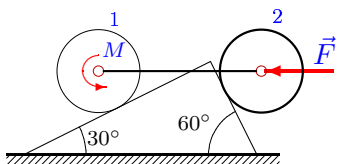
Система состоит из двух цилиндров весом P_1 и P_2 с одинаковыми радиусами R , соединенных однородным стержнем весом P_3 . Цилиндры могут кататься без проскальзывания, цилиндр 1 без сопротивления, а цилиндр 2 с трением качения (δ). Какова вероятность того, что система будет находиться в равновесии, если момент M есть случайная величина, равномерно распределенная на отрезке $[M_1, M_2]$

В ответах даны нормальные реакции опор и момент M для движения цилиндра 2 по часовой стрелке и против (последние три столбца).

Курсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.80.)

Задача L-26.1.

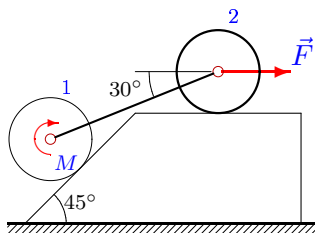
1



$P_1 = 24 \text{ Н}$, $P_2 = 26 \text{ Н}$, $P_3 = 20 \text{ Н}$,
 $M \in [10, 13] \text{ Нм}$, $F = 20 \text{ Н}$, $R = 60 \text{ см}$,
 $\delta = 4 \text{ мм}$.

Задача L-26.2.

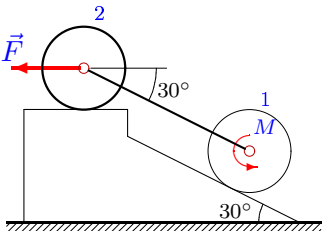
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$P_1 = 23 \text{ Н}$, $P_2 = 27 \text{ Н}$, $P_3 = 10 \text{ Н}$,
 $M \in [1, 3] \text{ Нм}$, $F = 15 \text{ Н}$, $R = 65 \text{ см}$,
 $\delta = 5 \text{ мм}$.

Задача L-26.3.

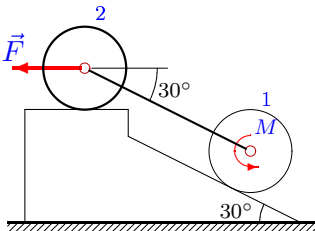
1



$P_1 = 25 \text{ Н}$, $P_2 = 26 \text{ Н}$, $P_3 = 10 \text{ Н}$,
 $M \in [-6, -4] \text{ Нм}$, $F = 25 \text{ Н}$, $R = 35 \text{ см}$,
 $\delta = 1 \text{ мм}$.

Задача L-26.4.

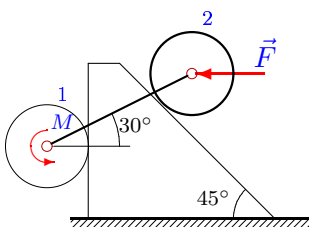
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$P_1 = 23 \text{ Н}$, $P_2 = 28 \text{ Н}$, $P_3 = 30 \text{ Н}$,
 $M \in [0, 2] \text{ Нм}$, $F = 15 \text{ Н}$, $R = 55 \text{ см}$,
 $\delta = 4 \text{ мм}$.

Задача L-26.5.

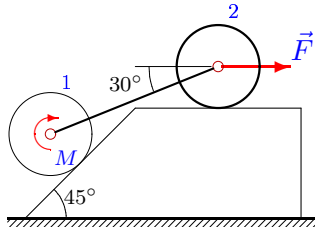
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$P_1 = 25 \text{ Н}$, $P_2 = 30 \text{ Н}$, $P_3 = 50 \text{ Н}$,
 $M \in [-4, -2] \text{ Нм}$, $F = 25 \text{ Н}$, $R = 35 \text{ см}$,
 $\delta = 1 \text{ мм}$.

Задача L-26.6.

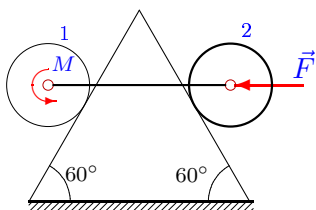
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$P_1 = 24 \text{ Н}$, $P_2 = 26 \text{ Н}$, $P_3 = 20 \text{ Н}$,
 $M \in [0, 2] \text{ Нм}$, $F = 20 \text{ Н}$, $R = 70 \text{ см}$,
 $\delta = 5 \text{ мм}$.

Задача L-26.7.

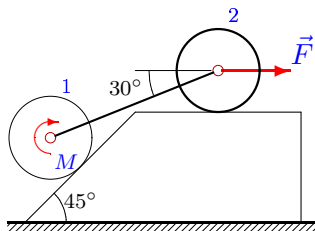
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$P_1 = 12 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [-1, 1] \text{ Нм}, F = 25 \text{ H}, R = 35 \text{ см},$
 $\delta = 1 \text{ мм}.$

Задача L-26.8.

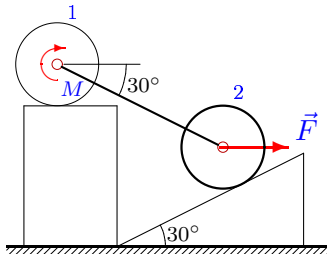
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$P_1 = 22 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [3, 6] \text{ Нм}, F = 10 \text{ H}, R = 30 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.9.

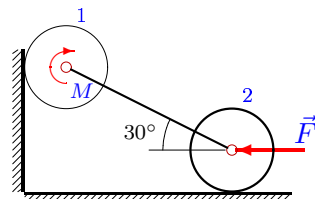
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$P_1 = 22 \text{ H}, P_2 = 23 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [4, 7] \text{ Нм}, F = 10 \text{ H}, R = 60 \text{ см},$
 $\delta = 5 \text{ мм}.$

Задача L-26.10.

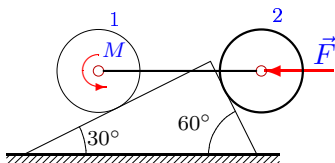
1



$P_1 = 6 \text{ H}, P_2 = 27 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [7, 9] \text{ Нм}, F = 50 \text{ H}, R = 45 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.11.

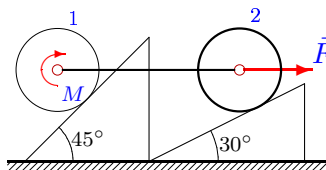
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$P_1 = 23 \text{ H}, P_2 = 25 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [10, 13] \text{ Нм}, F = 15 \text{ H}, R = 65 \text{ см},$
 $\delta = 5 \text{ мм}.$

Задача L-26.12.

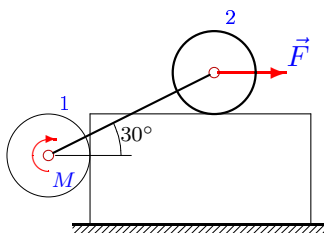
1



$P_1 = 24 \text{ H}, P_2 = 26 \text{ H}, P_3 = 50 \text{ H},$
 $M \in [20, 22] \text{ Нм}, F = 20 \text{ H}, R = 50 \text{ см},$
 $\delta = 3 \text{ мм}.$

Задача L-26.13.

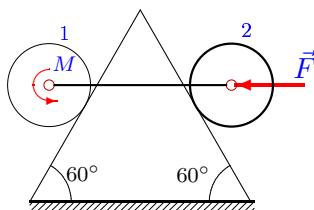
1



$P_1 = 25 \text{ H}, P_2 = 28 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [8, 10] \text{ Нм}, F = 25 \text{ H}, R = 35 \text{ см},$
 $\delta = 1 \text{ мм}.$

Задача L-26.14.

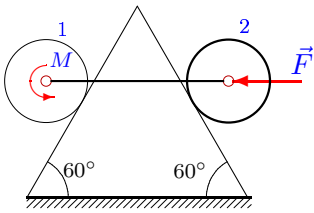
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$P_1 = 12 \text{ H}, P_2 = 25 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [-1, 2] \text{ Нм}, F = 20 \text{ H}, R = 50 \text{ см},$
 $\delta = 3 \text{ мм}.$

Задача L-26.15.

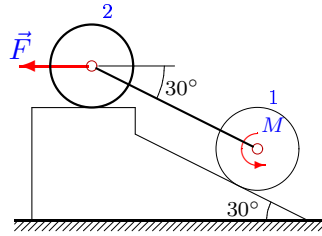
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$P_1 = 12 \text{ H}, P_2 = 30 \text{ H}, P_3 = 40 \text{ H},$
 $M \in [1, 3] \text{ Нм}, F = 25 \text{ H}, R = 65 \text{ см},$
 $\delta = 4 \text{ мм}.$

Задача L-26.16.

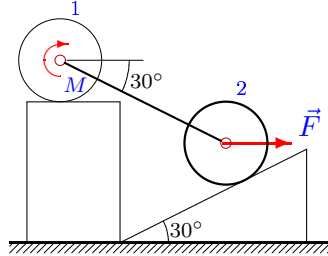
1



$P_1 = 21 \text{ H}, P_2 = 23 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [2, 4] \text{ Нм}, F = 5 \text{ H}, R = 45 \text{ см}, \delta =$
 $4 \text{ мм}.$

Задача L-26.17.

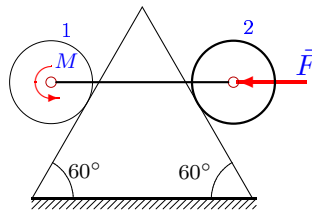
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$P_1 = 24 \text{ H}, P_2 = 28 \text{ H}, P_3 = 40 \text{ H},$
 $M \in [4, 7] \text{ Нм}, F = 20 \text{ H}, R = 50 \text{ см},$
 $\delta = 3 \text{ мм}.$

Задача L-26.18.

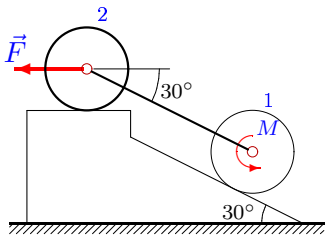
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$P_1 = 11 \text{ H}, P_2 = 27 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [2, 5] \text{ Нм}, F = 10 \text{ H}, R = 40 \text{ см},$
 $\delta = 3 \text{ мм}.$

Задача L-26.19.

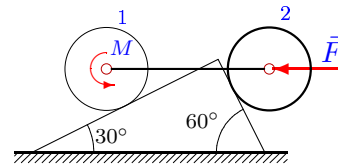
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$P_1 = 21 \text{ H}, P_2 = 25 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [1, 3] \text{ Нм}, F = 5 \text{ H}, R = 15 \text{ см}, \delta =$
 $1 \text{ мм}.$

Задача L-26.20.

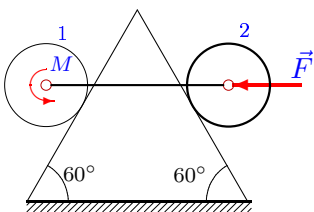
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$P_1 = 23 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [9, 12] \text{ Нм}, F = 15 \text{ H}, R = 35 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.21.

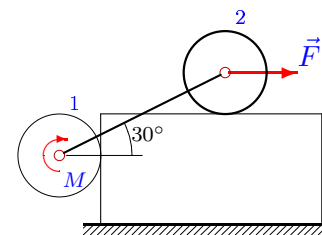
1



$P_1 = 12 \text{ H}, P_2 = 30 \text{ H}, P_3 = 40 \text{ H},$
 $M \in [1, 4] \text{ Нм}, F = 25 \text{ H}, R = 75 \text{ см},$
 $\delta = 5 \text{ мм}.$

Задача L-26.22.

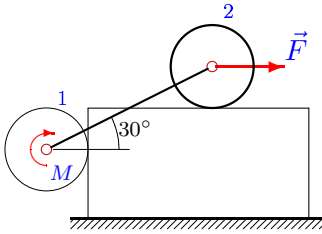
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$P_1 = 22 \text{ H}, P_2 = 23 \text{ H}, P_3 = 20 \text{ H},$
 $M \in [7, 9] \text{ Нм}, F = 10 \text{ H}, R = 30 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.23.

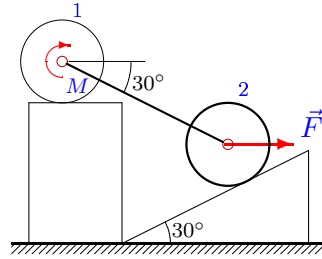
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$P_1 = 23 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [9, 11] \text{ Нм}, F = 15 \text{ H}, R = 35 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.24.

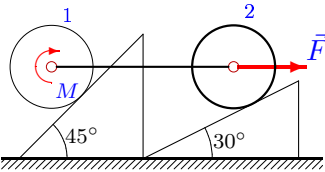
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$P_1 = 22 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [3, 5] \text{ Нм}, F = 10 \text{ H}, R = 20 \text{ см},$
 $\delta = 1 \text{ мм}.$

Задача L-26.25.

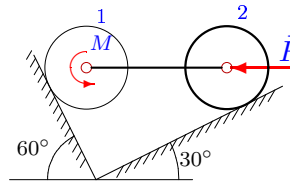
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$P_1 = 25 \text{ H}, P_2 = 26 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [14, 16] \text{ Нм}, F = 25 \text{ H}, R = 55 \text{ см},$
 $\delta = 3 \text{ мм}.$

Задача L-26.26.

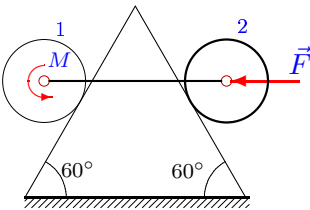
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$P_1 = 22 \text{ H}, P_2 = 25 \text{ H}, P_3 = 20 \text{ H},$
 $M \in [1, 4] \text{ Нм}, F = 10 \text{ H}, R = 20 \text{ см},$
 $\delta = 1 \text{ мм}.$

Задача L-26.27.

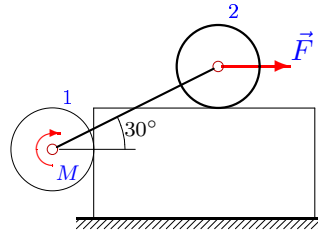
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$P_1 = 12 \text{ H}, P_2 = 27 \text{ H}, P_3 = 30 \text{ H},$
 $M \in [0, 2] \text{ Нм}, F = 20 \text{ H}, R = 40 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.28.

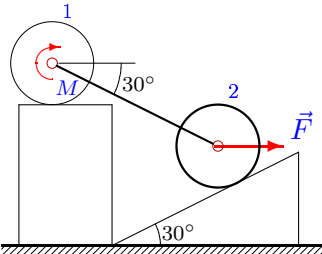
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$P_1 = 25 \text{ H}, P_2 = 29 \text{ H}, P_3 = 20 \text{ H},$
 $M \in [8, 10] \text{ Нм}, F = 25 \text{ H}, R = 45 \text{ см},$
 $\delta = 2 \text{ мм}.$

Задача L-26.29.

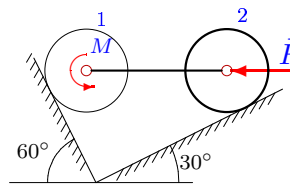
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$P_1 = 21 \text{ H}, P_2 = 25 \text{ H}, P_3 = 50 \text{ H},$
 $M \in [4, 7] \text{ Нм}, F = 5 \text{ H}, R = 15 \text{ см}, \delta =$
 $1 \text{ мм}.$

Задача L-26.30.

1



$P_1 = 24 \text{ H}, P_2 = 28 \text{ H}, P_3 = 10 \text{ H},$
 $M \in [1, 3] \text{ Нм}, F = 20 \text{ H}, R = 40 \text{ см},$
 $\delta = 2 \text{ мм}.$

Отвeты.
Трение качения

22-Jan-16

	N_1	N_2	M	N_1	N_2	M	p
	H		Hm	H		Hm	%
1	50.147	71.178	11.315	51.107	72.841	12.312	33.260
2	24.189	40.480	2.220	24.376	40.842	1.767	22.676
3	25.981	45.509	-4.906	25.981	45.359	-4.801	5.246
4	32.909	51.878	0.684	32.909	51.444	1.161	23.861
5	69.697	134.305	-3.416	72.292	137.200	-2.892	26.225
6	29.918	47.352	1.478	30.121	47.744	0.948	26.516
7	52.946	81.596	-0.213	53.757	82.408	-0.049	8.200
8	29.059	46.594	4.607	29.245	46.954	4.398	6.956
9	21.335	39.061	5.888	21.977	37.950	5.221	22.231
10	50.271	61.024	8.111	49.730	60.712	7.970	7.028
11	42.274	59.211	11.193	43.197	60.810	12.233	34.647
12	27.680	59.094	20.808	28.257	58.686	20.520	14.425
13	24.836	57.339	8.981	25.164	57.529	8.915	3.316
14	55.357	79.177	0.392	57.020	80.840	0.872	16.002
15	68.295	98.945	1.612	70.427	101.077	2.412	40.005
16	22.517	31.046	3.109	22.517	30.729	3.394	14.266
17	36.938	63.801	6.116	37.695	62.489	5.460	21.874
18	46.519	63.179	3.353	48.182	64.842	3.737	12.802
19	31.177	43.052	1.784	31.177	42.722	1.883	4.952
20	60.452	81.196	10.047	61.389	82.820	10.615	18.939
21	68.208	98.858	1.822	70.518	101.168	2.822	33.338
22	9.743	38.625	7.913	10.259	38.923	7.823	4.477
23	14.717	49.497	10.326	15.285	49.825	10.211	5.734
24	24.853	61.547	4.208	25.463	60.490	3.997	10.569
25	29.012	47.492	15.156	29.434	47.194	14.924	11.597
26	42.363	40.532	2.498	41.959	40.298	2.545	1.556
27	58.458	83.279	1.030	59.913	84.734	1.366	16.801
28	24.763	53.297	9.316	25.238	53.571	9.193	6.170
29	24.780	82.556	5.513	25.868	80.671	5.230	9.424
30	48.512	38.215	2.191	48.131	37.995	2.279	4.400

L-26 файл o26L1A