

Трение качения

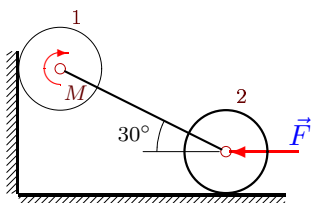
Система состоит из двух цилиндров весом P_1 и P_2 с одинаковыми радиусами R , соединенных однородным стержнем весом P_3 . Цилиндры могут кататься без проскальзывания, цилиндр 1 без сопротивления, а цилиндр 2 с трением качения (δ). В каких пределах меняется внешний момент M при условии равновесия системы?

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

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

Задача S-18.1.

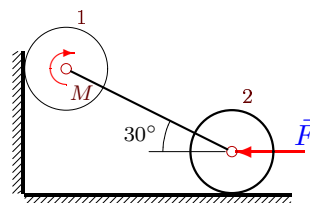
8



$$P_1 = 5 \text{ Н}, P_2 = 23 \text{ Н}, P_3 = 10 \text{ Н}, \\ F = 10 \text{ Н}, R = 55 \text{ см}, \delta = 5 \text{ мм}.$$

Задача S-18.2.

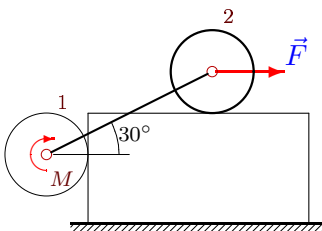
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$$P_1 = 5 \text{ Н}, P_2 = 24 \text{ Н}, P_3 = 30 \text{ Н}, \\ F = 30 \text{ Н}, R = 45 \text{ см}, \delta = 3 \text{ мм}.$$

Задача S-18.3.

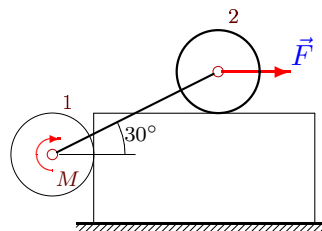
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$$P_1 = 22 \text{ Н}, P_2 = 24 \text{ Н}, P_3 = 20 \text{ Н}, \\ F = 10 \text{ Н}, R = 60 \text{ см}, \delta = 5 \text{ мм}.$$

Задача S-18.4.

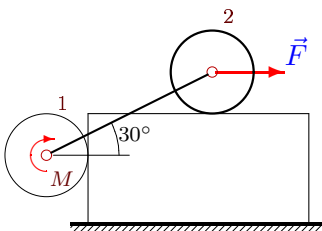
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$$P_1 = 24 \text{ Н}, P_2 = 27 \text{ Н}, P_3 = 30 \text{ Н}, \\ F = 20 \text{ Н}, R = 30 \text{ см}, \delta = 1 \text{ мм}.$$

Задача S-18.5.

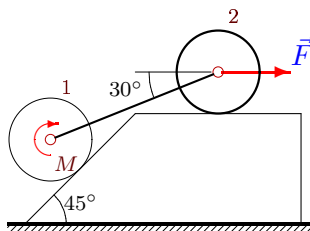
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$$P_1 = 21 \text{ Н}, P_2 = 25 \text{ Н}, P_3 = 50 \text{ Н}, \\ F = 5 \text{ Н}, R = 15 \text{ см}, \delta = 1 \text{ мм}.$$

Задача S-18.6.

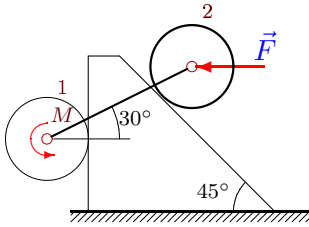
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$$P_1 = 25 \text{ Н}, P_2 = 29 \text{ Н}, P_3 = 20 \text{ Н}, \\ F = 25 \text{ Н}, R = 75 \text{ см}, \delta = 5 \text{ мм}.$$

Задача S-18.7.

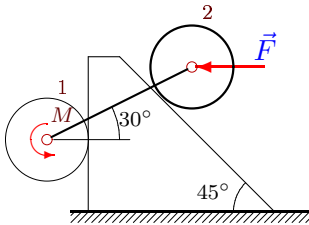
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$P_1 = 21 \text{ H}, P_2 = 23 \text{ H}, P_3 = 40 \text{ H},$
 $F = 5 \text{ H}, R = 45 \text{ см}, \delta = 4 \text{ мм}.$

Задача S-18.9.

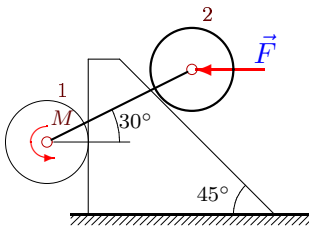
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$P_1 = 21 \text{ H}, P_2 = 24 \text{ H}, P_3 = 10 \text{ H},$
 $F = 5 \text{ H}, R = 15 \text{ см}, \delta = 1 \text{ мм}.$

Задача S-18.11.

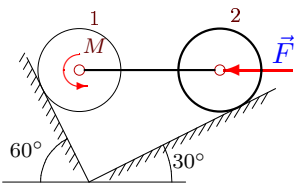
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$P_1 = 23 \text{ H}, P_2 = 24 \text{ H}, P_3 = 50 \text{ H},$
 $F = 15 \text{ H}, R = 45 \text{ см}, \delta = 3 \text{ мм}.$

Задача S-18.13.

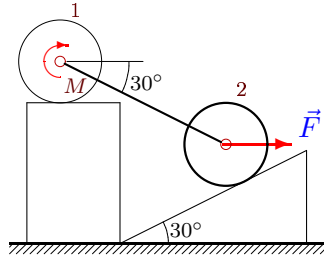
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$P_1 = 22 \text{ H}, P_2 = 27 \text{ H}, P_3 = 30 \text{ H},$
 $F = 10 \text{ H}, R = 60 \text{ см}, \delta = 5 \text{ мм}.$

Задача S-18.8.

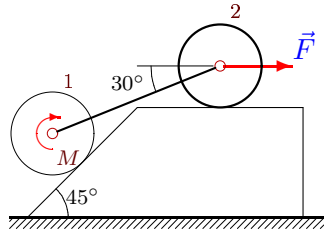
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$P_1 = 24 \text{ H}, P_2 = 25 \text{ H}, P_3 = 30 \text{ H},$
 $F = 20 \text{ H}, R = 40 \text{ см}, \delta = 2 \text{ мм}.$

Задача S-18.10.

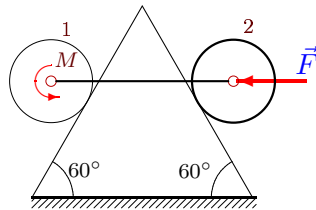
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$P_1 = 24 \text{ H}, P_2 = 25 \text{ H}, P_3 = 40 \text{ H},$
 $F = 20 \text{ H}, R = 50 \text{ см}, \delta = 3 \text{ мм}.$

Задача S-18.12.

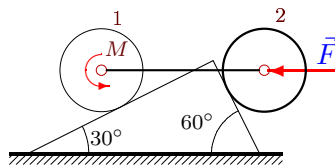
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$P_1 = 12 \text{ H}, P_2 = 29 \text{ H}, P_3 = 40 \text{ H},$
 $F = 25 \text{ H}, R = 35 \text{ см}, \delta = 1 \text{ мм}.$

Задача S-18.14.

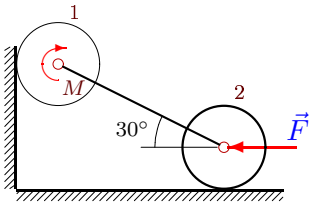
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$P_1 = 24 \text{ H}, P_2 = 26 \text{ H}, P_3 = 20 \text{ H},$
 $F = 20 \text{ H}, R = 50 \text{ см}, \delta = 3 \text{ мм}.$

Задача S-18.15.

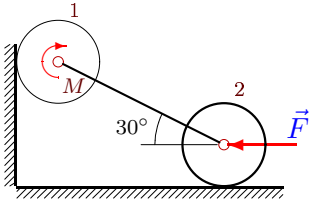
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$P_1 = 6 \text{ H}, P_2 = 26 \text{ H}, P_3 = 40 \text{ H},$
 $F = 40 \text{ H}, R = 60 \text{ см}, \delta = 4 \text{ мм}.$

Задача S-18.17.

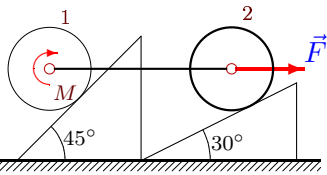
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$P_1 = 5 \text{ H}, P_2 = 24 \text{ H}, P_3 = 10 \text{ H},$
 $F = 20 \text{ H}, R = 50 \text{ см}, \delta = 4 \text{ мм}.$

Задача S-18.19.

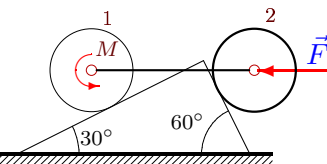
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$P_1 = 22 \text{ H}, P_2 = 26 \text{ H}, P_3 = 50 \text{ H},$
 $F = 10 \text{ H}, R = 60 \text{ см}, \delta = 5 \text{ мм}.$

Задача S-18.21.

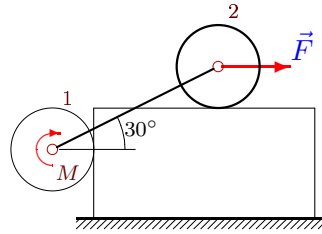
8



$P_1 = 21 \text{ H}, P_2 = 22 \text{ H}, P_3 = 20 \text{ H},$
 $F = 5 \text{ H}, R = 45 \text{ см}, \delta = 4 \text{ мм}.$

Задача S-18.16.

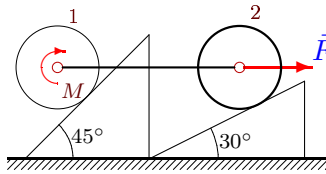
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$P_1 = 21 \text{ H}, P_2 = 22 \text{ H}, P_3 = 20 \text{ H},$
 $F = 5 \text{ H}, R = 15 \text{ см}, \delta = 1 \text{ мм}.$

Задача S-18.18.

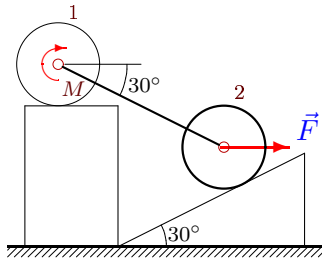
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$P_1 = 21 \text{ H}, P_2 = 24 \text{ H}, P_3 = 40 \text{ H},$
 $F = 5 \text{ H}, R = 15 \text{ см}, \delta = 1 \text{ мм}.$

Задача S-18.20.

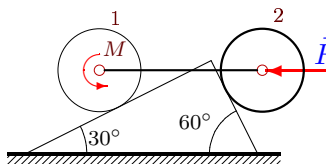
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$P_1 = 24 \text{ H}, P_2 = 27 \text{ H}, P_3 = 10 \text{ H},$
 $F = 20 \text{ H}, R = 60 \text{ см}, \delta = 4 \text{ мм}.$

Задача S-18.22.

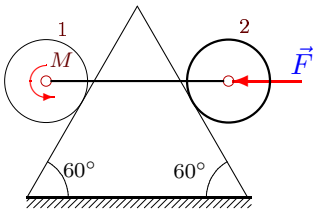
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$P_1 = 22 \text{ H}, P_2 = 25 \text{ H}, P_3 = 50 \text{ H},$
 $F = 10 \text{ H}, R = 60 \text{ см}, \delta = 5 \text{ мм}.$

Задача S-18.23.

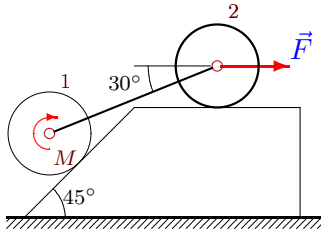
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$P_1 = 11 \text{ H}$, $P_2 = 26 \text{ H}$, $P_3 = 50 \text{ H}$,
 $F = 15 \text{ H}$, $R = 25 \text{ см}$, $\delta = 1 \text{ мм}$.

Задача S-18.25.

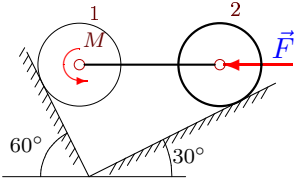
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$P_1 = 24 \text{ H}$, $P_2 = 25 \text{ H}$, $P_3 = 20 \text{ H}$,
 $F = 20 \text{ H}$, $R = 50 \text{ см}$, $\delta = 3 \text{ мм}$.

Задача S-18.27.

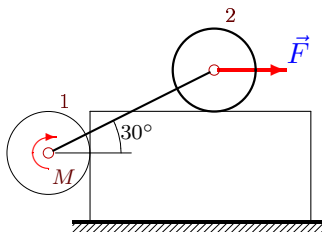
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$P_1 = 21 \text{ H}$, $P_2 = 25 \text{ H}$, $P_3 = 10 \text{ H}$,
 $F = 5 \text{ H}$, $R = 15 \text{ см}$, $\delta = 1 \text{ мм}$.

Задача S-18.29.

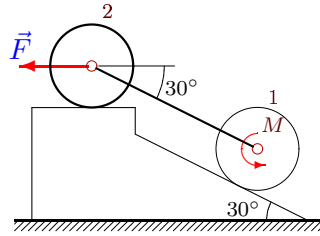
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$P_1 = 22 \text{ H}$, $P_2 = 24 \text{ H}$, $P_3 = 10 \text{ H}$,
 $F = 10 \text{ H}$, $R = 50 \text{ см}$, $\delta = 4 \text{ мм}$.

Задача S-18.24.

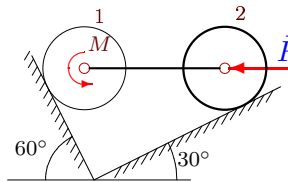
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$P_1 = 22 \text{ H}$, $P_2 = 25 \text{ H}$, $P_3 = 30 \text{ H}$,
 $F = 10 \text{ H}$, $R = 60 \text{ см}$, $\delta = 5 \text{ мм}$.

Задача S-18.26.

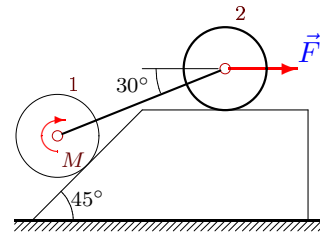
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$P_1 = 24 \text{ H}$, $P_2 = 26 \text{ H}$, $P_3 = 10 \text{ H}$,
 $F = 20 \text{ H}$, $R = 60 \text{ см}$, $\delta = 4 \text{ мм}$.

Задача S-18.28.

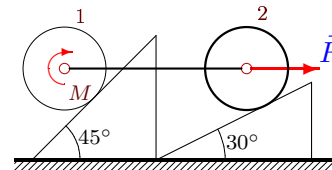
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$P_1 = 22 \text{ H}$, $P_2 = 25 \text{ H}$, $P_3 = 30 \text{ H}$,
 $F = 10 \text{ H}$, $R = 50 \text{ см}$, $\delta = 4 \text{ мм}$.

Задача S-18.30.

8



$P_1 = 21 \text{ H}$, $P_2 = 23 \text{ H}$, $P_3 = 40 \text{ H}$,
 $F = 5 \text{ H}$, $R = 15 \text{ см}$, $\delta = 1 \text{ мм}$.

S-18

Ответы.

Трение качения

19.12.2014

	N_1	N_2	M	N_1	N_2	M
	H		Hm	H		Hm
1	10.309	33.952	-2.227	9.695	33.597	-2.422
2	30.377	56.538	-1.108	29.626	56.105	-1.303
3	9.670	39.583	15.850	10.333	39.966	15.621
4	19.822	53.444	8.267	20.179	53.650	8.205
5	4.649	52.684	6.497	5.354	53.091	6.436
6	32.114	53.229	-2.055	32.327	53.640	-2.650
7	86.045	129.912	3.905	94.038	138.827	5.982
8	36.072	49.713	2.029	36.565	48.859	1.687
9	54.883	85.255	0.853	58.783	89.606	1.191
10	36.989	56.352	4.591	37.192	56.744	4.213
11	77.507	131.703	-1.463	83.533	138.423	0.102
12	67.367	97.517	0.680	68.337	98.487	0.876
13	48.566	48.732	8.810	47.758	48.265	9.090
14	50.194	71.259	9.469	51.058	72.756	10.218
15	40.462	69.361	-1.583	39.541	68.829	-1.903
16	4.768	34.753	4.237	5.233	35.022	4.197
17	20.326	40.735	0.868	19.677	40.361	0.680
18	14.286	51.003	6.554	14.839	50.612	6.471
19	19.082	59.174	28.432	19.883	58.608	27.951
20	30.082	35.839	-1.124	30.554	35.021	-1.615
21	51.499	63.030	12.240	52.637	65.001	13.127
22	78.183	98.577	24.850	79.850	101.465	26.583
23	80.808	101.298	1.271	82.221	102.712	1.475
24	32.043	45.995	3.906	32.043	45.554	4.435
25	29.936	46.386	1.022	30.103	46.709	0.711
26	47.560	35.934	3.616	47.083	35.658	3.782
27	32.562	34.775	1.683	32.100	34.508	1.723
28	29.043	45.563	7.708	29.261	45.986	7.300
29	9.723	34.614	10.693	10.279	34.935	10.533
30	14.701	49.844	6.492	15.241	49.462	6.411

S-18 файл о18s8B