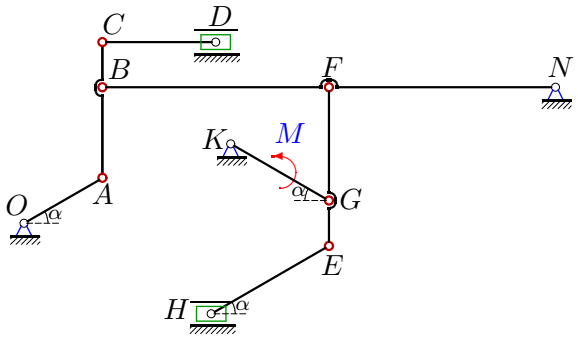
Условие равновесия механизма

Плоский многозвенный механизм с одной степенью свободы находится в равновесии. К кривошипу OA приложен момент M. Размеры даны в сантиметрах. Дан ряд p распределения дискретной случайной величины силы сопротивления в ползунах $T_i, i = 1, ..., 4$. Найти математическое ожидание и дисперсию момента M.

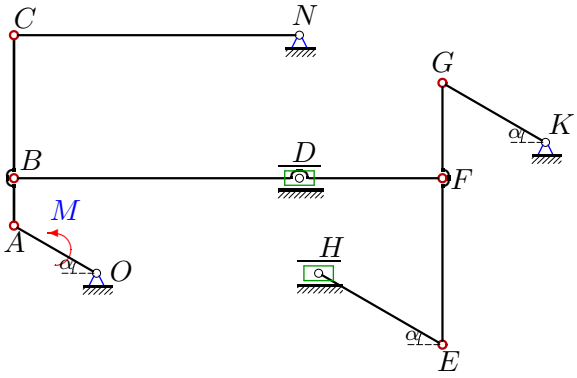
Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.158.)

Задача L-27.1. 2



$\alpha = 30°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 25$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5]$ Н.

Задача L-27.2. 2



$\alpha = 30°$,
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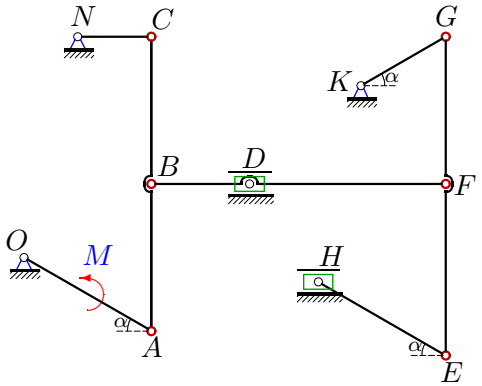
$DB = 60$, $DF = 30$,
$NC = 60$, $EH = 30$,
$FE = 35$, $FG = 20$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ Н.

Задача L-27.3. 2



$\alpha = 30°$,
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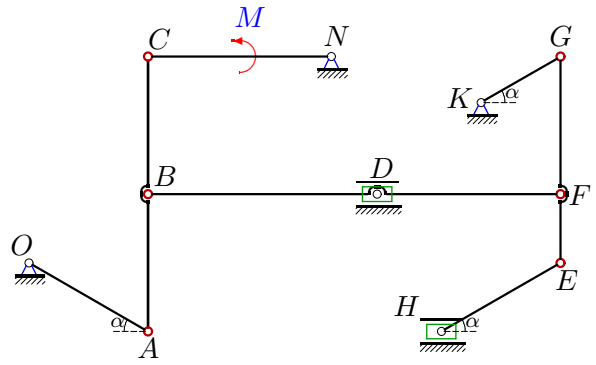
$DB = 20$, $DF = 40$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 30$,
$OA = 30$, $KG = 20$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5]$ Н.

Задача L-27.4.



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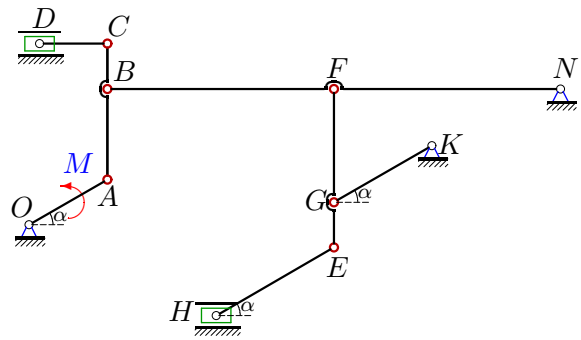
$DB = 50$, $DF = 40$,
$NC = 40$, $EH = 30$,
$FE = 15$, $FG = 30$,
$OA = 30$, $KG = 20$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5]$ Н.

Задача L-27.5.



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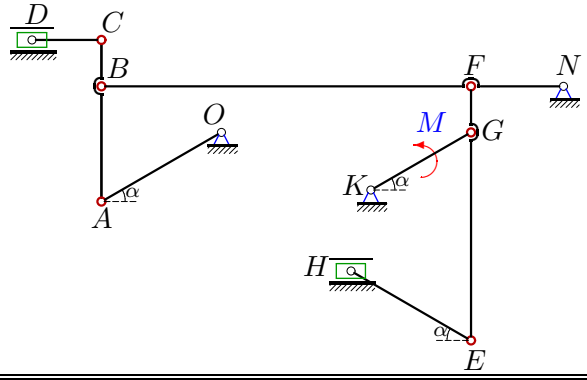
$BF = 50$, $NF = 50$,
$CD = 15$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5.5]$ Н.

Задача L-27.6.



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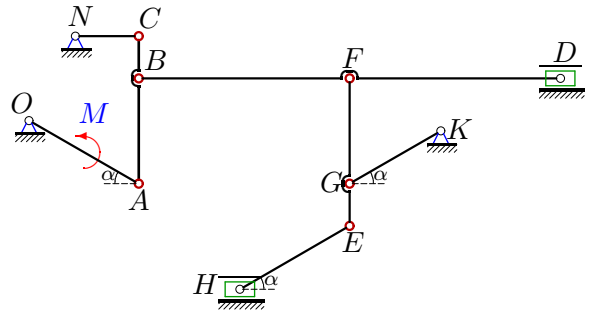
$CD = 15$, $EH = 30$,
$FG = 10$, $GE = 45$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7, 6.5, 5.5]$ Н.

Задача L-27.7.



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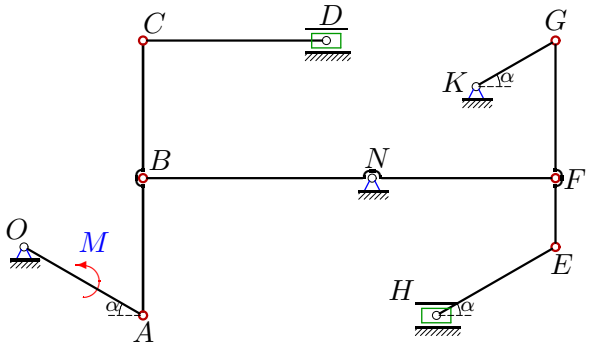
$BF = 50$, $FD = 50$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 25$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ Н.

Задача L-27.8.



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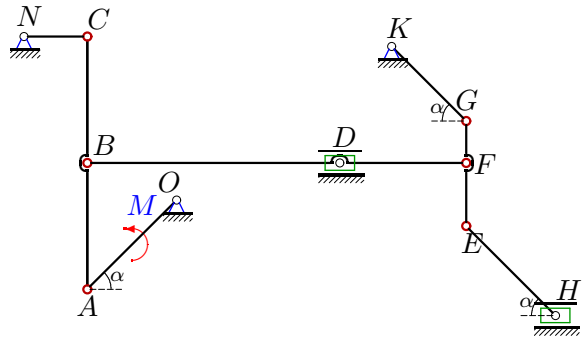
$NB = 50$, $NF = 40$,
$CD = 40$, $EH = 30$,
$FE = 15$, $FG = 30$,
$OA = 30$, $KG = 20$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5.5]$ Н.

Задача L-27.9.



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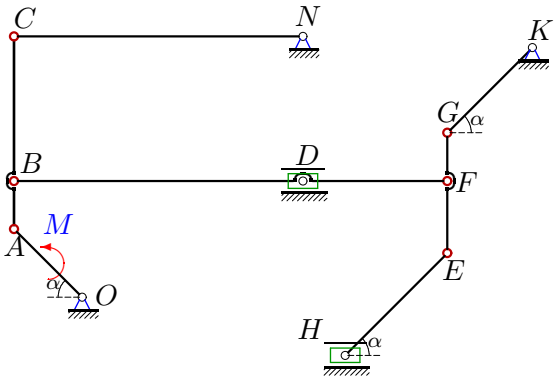
$DB = 60$, $DF = 30$,
$NC = 15$, $EH = 30$,
$FE = 15$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6, 5]$ Н.

Задача L-27.10.



$\alpha = 45°$,
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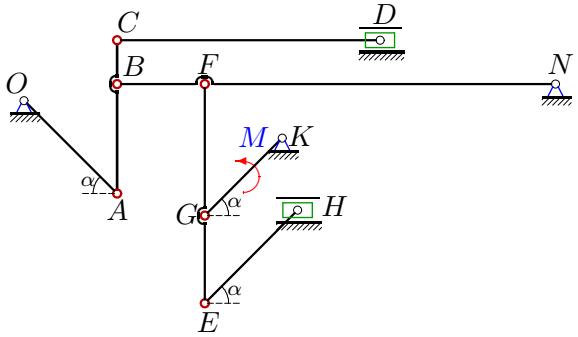
$DB = 60$, $DF = 30$,
$NC = 60$, $EH = 30$,
$FE = 15$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5]$ Н.

Задача L-27.11.



$\alpha = 45°$,
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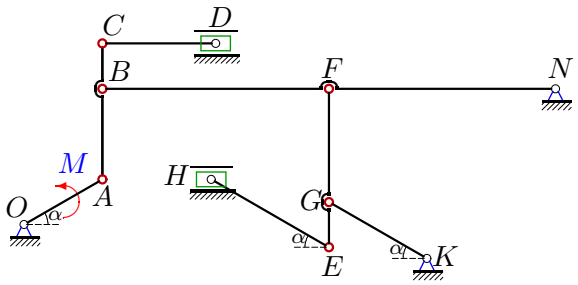
$BF = 20$, $NF = 80$,
$CD = 60$, $EH = 30$,
$FG = 30$, $GE = 20$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6.5, 5.5]$ Н.

Задача L-27.12.



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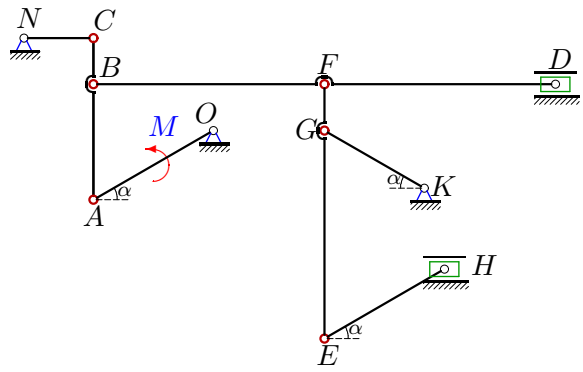
$BF = 50$, $NF = 50$,
$CD = 25$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5.5]$ Н.

Задача L-27.13.



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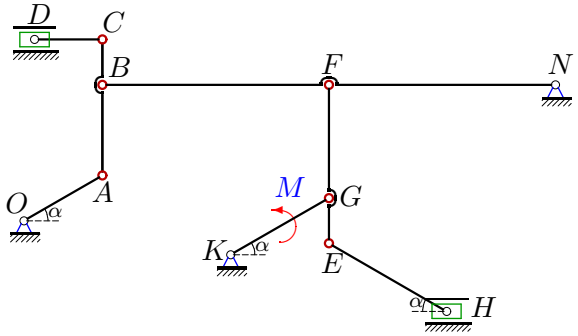
$BF = 50$, $FD = 50$,
$NC = 15$, $EH = 30$,
$FE = 55$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5.5]$ Н.

Задача L-27.14.



$\alpha = 30°$,
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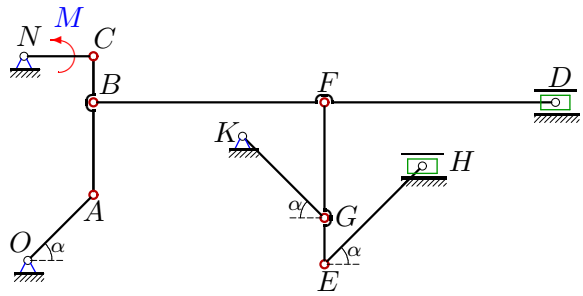
$BF = 50$, $NF = 50$,
$CD = 15$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ Н.

Задача L-27.15.



$\alpha = 45°$,
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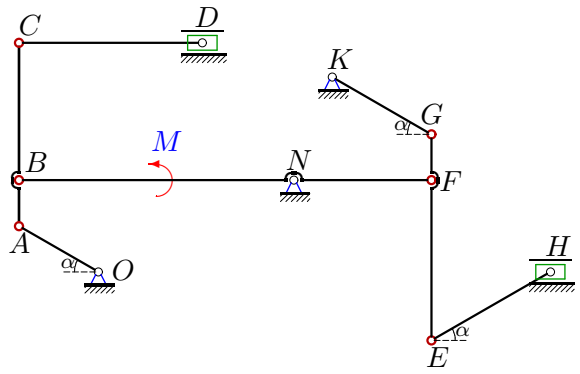
$BF = 50$, $FD = 50$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 25$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5.5]$ Н.

Задача L-27.16.



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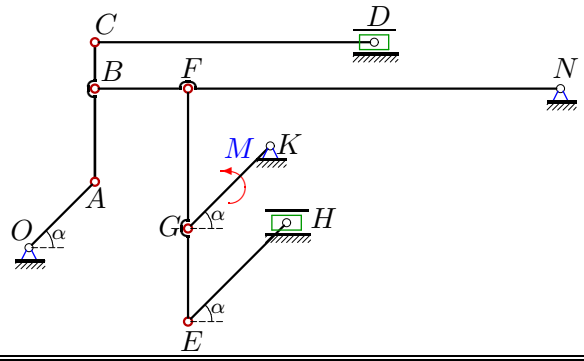
$NB = 60$, $NF = 30$,
$CD = 40$, $EH = 30$,
$FE = 35$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5.5]$ Н.

Задача L-27.17.



$\alpha = 45°$,
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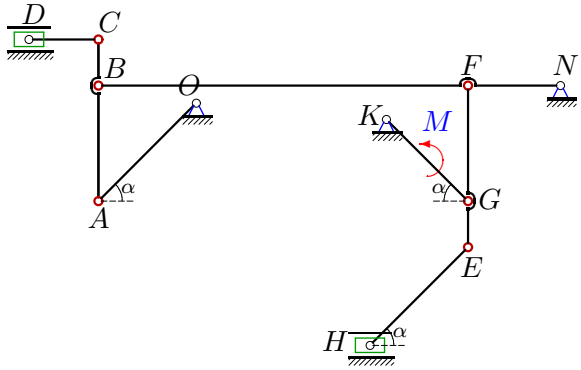
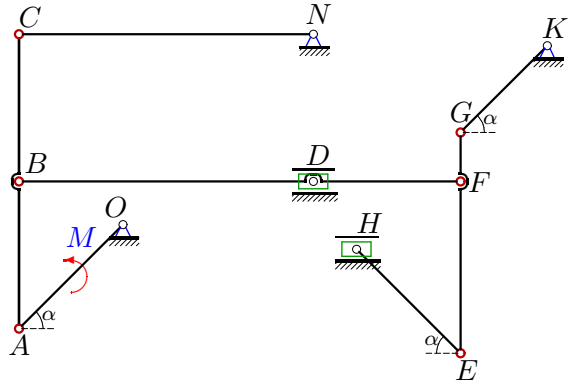
$BF = 20$, $NF = 80$,
$CD = 60$, $EH = 30$,
$FG = 30$, $GE = 20$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ Н.

Задача L-27.18.



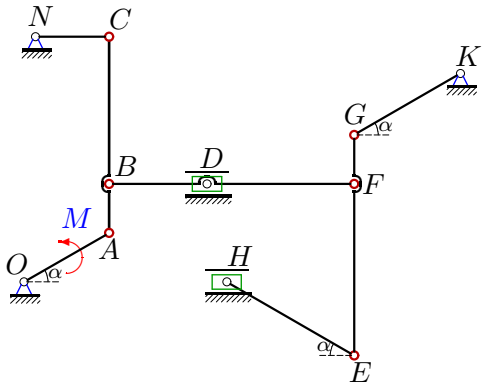
$\alpha = 45°$,
$AB = 25$, $BC = 10$,
$BF = 80$, $NF = 20$,
$CD = 15$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5.5]$ Н.

Задача L-27.19.



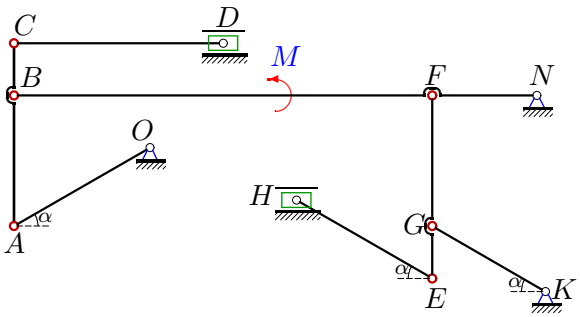
$\alpha = 45°$,
$AB = 30$, $BC = 30$,
$DB = 60$, $DF = 30$,
$NC = 60$, $EH = 30$,
$FE = 35$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ Н.

Задача L-27.20.



$\alpha = 30°$,
$AB = 10$, $BC = 30$,
$DB = 20$, $DF = 30$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5]$ Н.

Задача L-27.21.



$\alpha = 30°$,
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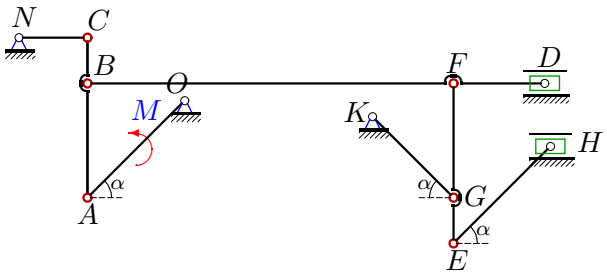
$BF = 80$, $NF = 20$,
$CD = 40$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5]$ Н.

Задача L-27.22.



$\alpha = 45°$,
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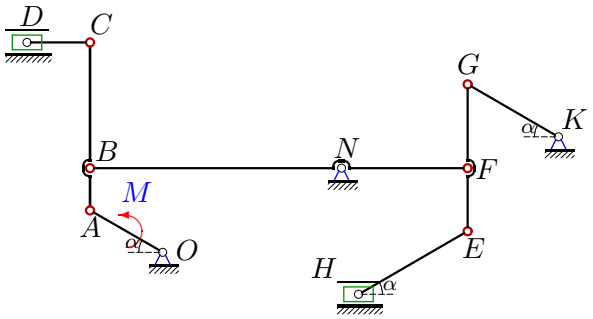
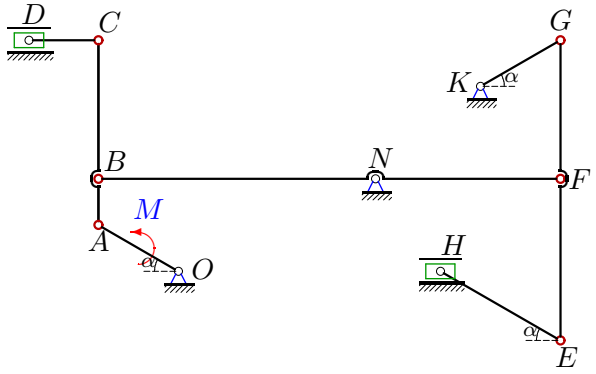
$BF = 80$, $FD = 20$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 25$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ Н.

Задача L-27.23.



$\alpha = 30°$,
$AB = 10$, $BC = 30$,
$NB = 60$, $NF = 30$,
$CD = 15$, $EH = 30$,
$FE = 15$, $FG = 20$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5]$ Н.

Задача L-27.24.



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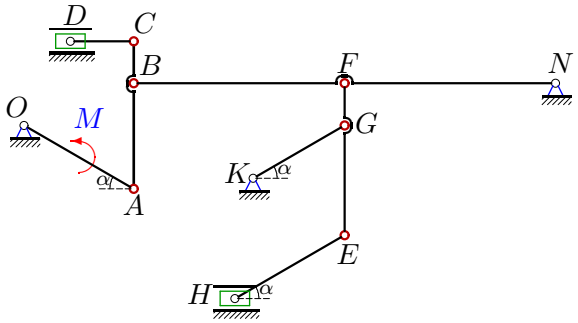
$NB = 60$, $NF = 40$,
$CD = 15$, $EH = 30$,
$FE = 35$, $FG = 30$,
$OA = 20$, $KG = 20$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5.5]$ Н.

Задача L-27.25.



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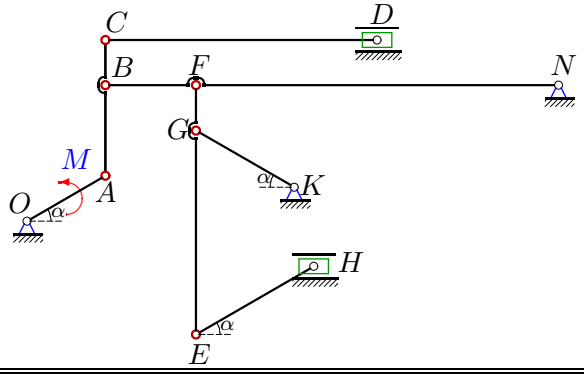
$CD = 15$, $EH = 30$,
$FG = 10$, $GE = 26$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5]$ Н.

Задача L-27.26.



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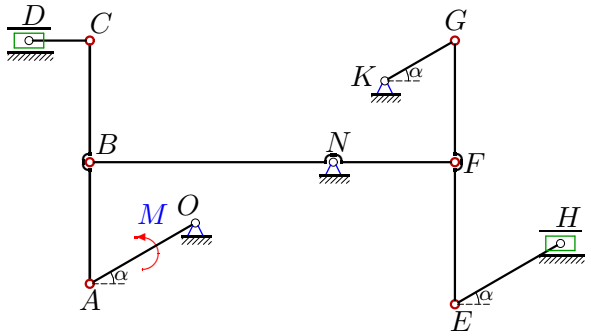
$BF = 20$, $NF = 80$,
$CD = 60$, $EH = 30$,
$FG = 10$, $GE = 45$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ Н.

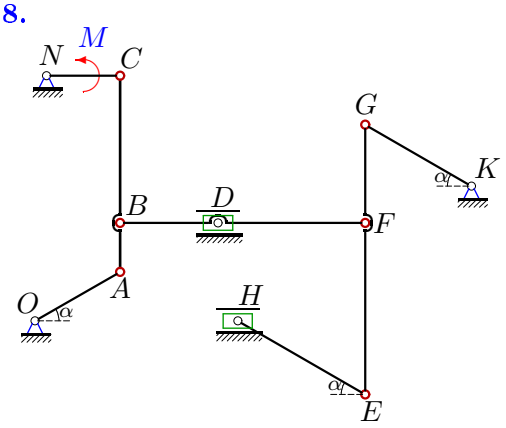
Задача L-27.27.



$\alpha = 30°$,
$AB = 30$, $BC = 30$,
$NB = 60$, $NF = 30$,
$CD = 15$, $EH = 30$,
$FE = 35$, $FG = 30$,
$OA = 30$, $KG = 20$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5.5]$ Н.

Задача L-27.28.

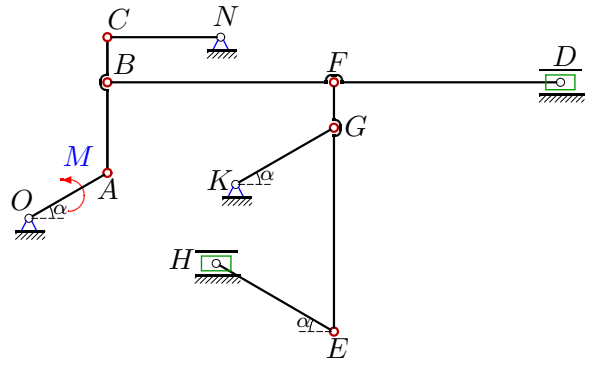
2



$\alpha = 30°$,
$AB = 10$, $BC = 30$,
$DB = 20$, $DF = 30$,
$NC = 15$, $EH = 30$,
$FE = 35$, $FG = 20$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6.5, 5.5]$ Н.

Задача L-27.29.

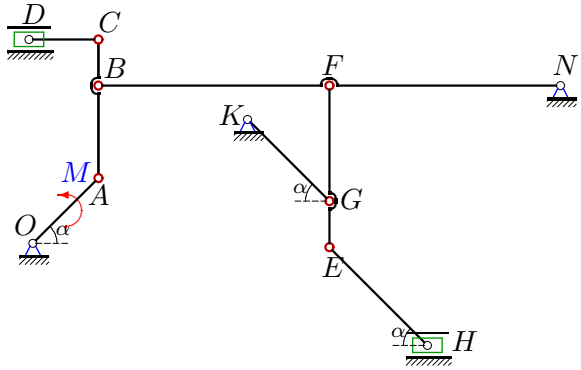
2



$\alpha = 30°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $FD = 50$,
$NC = 25$, $EH = 30$,
$FE = 55$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ Н.

Задача L-27.30.

2



$\alpha = 45°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 15$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5]$ Н.

Ответы.

Условие равновесия механизма

22-Jan-16

	v_A	v_B	v_C	v_D	v_E	v_F	v_G	v_H	M
1	50.000	43.301	45.069	12.500	27.839	21.651	25.000	30.000	274.125
2	20.000	18.875	17.321	7.500	30.625	11.456	10.000	34.375	270.094
3	30.000	27.042	25.981	7.500	55.241	52.500	60.000	11.250	120.938
4	46.188	41.633	40.000	11.547	33.005	34.020	36.950	10.392	145.896
5	20.000	17.321	18.028	5.000	11.136	8.660	10.000	2.000	44.975
6	125.000	108.253	111.102	25.000	72.079	21.651	25.000	81.250	701.250
7	30.000	26.332	25.981	4.286	17.831	13.679	15.000	4.714	57.825
8	30.000	25.981	30.000	15.000	21.633	20.785	24.000	18.000	216.150
9	30.000	23.717	21.213	10.607	15.000	15.000	15.000	0.000	66.291
10	20.000	17.678	14.142	10.607	17.410	12.748	10.000	8.839	124.451
11	31.250	22.097	23.799	8.839	34.359	17.678	25.000	11.785	138.180
12	20.000	17.321	18.028	5.000	11.136	8.660	10.000	2.000	45.675
13	30.000	26.332	25.981	4.286	61.914	13.679	15.000	68.036	459.241
14	50.000	43.301	45.069	12.500	27.839	21.651	25.000	30.000	278.375
15	21.213	15.811	15.000	5.000	14.577	9.014	10.607	20.000	168.125
16	69.282	60.000	120.000	103.923	67.639	30.000	34.641	43.301	968.000
17	31.250	22.097	24.705	11.049	34.359	17.678	25.000	11.785	150.702
18	125.000	88.388	95.197	35.355	30.414	17.678	25.000	42.426	507.526
19	30.000	23.717	21.213	10.607	85.513	15.000	15.000	74.246	545.179
20	20.000	18.875	17.321	7.500	90.078	27.042	30.000	71.250	496.125
21	115.470	100.000	102.632	23.094	25.716	20.000	23.094	4.619	174.591
22	30.000	22.062	21.213	6.061	9.379	7.398	6.000	12.607	122.273
23	20.000	17.321	34.641	30.000	9.437	8.660	10.000	1.250	194.531
24	20.000	17.321	34.641	30.000	13.922	11.547	13.333	1.111	203.000
25	30.000	25.981	26.665	6.000	29.962	12.990	15.000	19.500	164.475
26	20.000	17.321	18.028	5.000	46.130	13.856	16.000	52.000	366.225
27	30.000	25.981	30.000	15.000	15.662	12.990	15.000	16.250	203.906
28	17.321	16.346	15.000	6.495	23.021	23.419	25.981	17.862	163.192
29	20.000	17.638	17.321	3.333	15.207	9.280	10.000	17.500	136.458
30	20.000	14.142	15.811	7.071	12.166	7.071	10.000	2.828	64.347

L-27 файл o27L2A

№	ω_{OA}	ω_{CA}	ω_{CD}	ω_{BF}	ω_{FE}	ω_{KG}	ω_{EH}	ω_{NC}
1	2.500	-1.250	-1.732	-0.433	0.500	1.000	0.833	–
2	1.000	-0.250	–	0.289	-0.625	-0.400	0.333	0.289
3	1.000	0.250	–	-1.299	-0.750	-3.000	-2.000	1.732
4	-1.540	-0.385	–	0.800	0.231	1.848	1.232	1.000
5	1.000	-0.500	1.155	-0.173	-0.200	-0.400	0.333	–
6	-4.167	-2.500	7.217	-1.083	-1.250	1.000	0.833	–
7	1.000	0.429	–	-0.260	-0.471	-0.600	0.500	1.732
8	1.000	0.500	-0.650	-0.520	-0.400	-1.200	-0.800	–
9	1.000	0.354	–	0.354	0.000	0.600	-0.500	-1.414
10	1.000	-0.354	–	0.236	-0.354	-0.400	0.333	0.236
11	-1.042	-0.884	0.368	0.221	0.589	1.000	0.833	–
12	1.000	-0.500	-0.693	-0.173	0.200	-0.400	0.333	–
13	1.000	0.429	–	0.260	-1.179	0.600	0.500	-1.732
14	2.500	-1.250	2.887	-0.433	-0.500	1.000	-0.833	–
15	1.061	-0.500	–	-0.150	0.500	0.424	-0.354	1.000
16	3.464	-3.464	1.500	1.000	-1.732	1.386	-1.155	–
17	-1.563	1.105	0.368	0.221	0.589	1.000	0.833	–
18	-4.167	-3.536	5.893	-0.884	0.707	1.000	0.833	–
19	1.000	0.354	–	0.354	2.121	-0.600	0.500	0.354
20	1.000	-0.250	–	-0.866	-2.250	1.200	-1.000	1.155
21	3.849	2.309	2.500	1.000	-0.462	0.924	-0.770	–
22	1.000	0.606	–	0.212	-0.412	-0.240	0.200	-1.414
23	1.000	-1.000	-1.155	0.289	-0.250	-0.400	0.333	–
24	1.000	-1.000	-1.155	0.289	0.222	0.667	0.444	–
25	1.000	0.600	1.732	-0.260	-0.750	0.600	0.500	–
26	1.000	-0.500	-0.289	-0.173	0.800	-0.640	-0.533	–
27	1.000	0.500	-1.732	0.433	0.250	0.750	-0.500	–
28	0.866	-0.217	–	-0.750	0.325	1.039	-0.866	1.000
29	1.000	-0.333	–	-0.173	-0.167	0.400	0.333	-0.693
30	1.000	-0.707	0.943	-0.141	0.283	0.400	-0.333	–