

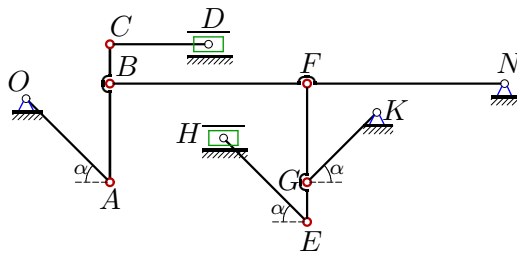
Кинематический анализ механизма (7 звеньев)

Плоский многосвязный механизм с одной степенью свободы приводится в движение кривошипом, который вращается против часовой стрелки с постоянной угловой скоростью. Найти скорости всех шарниров механизма (в см/с) и ускорения трех заданных шарниров (в м/с²). Размеры даны в сантиметрах.

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

Задача К9.1.

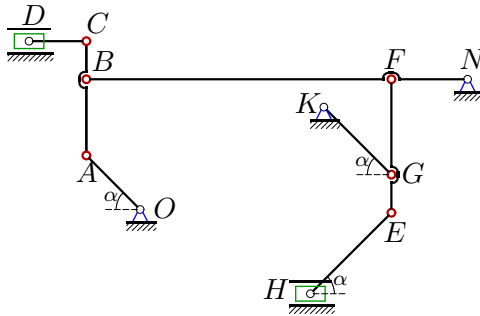
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$\omega_{NB} = 2$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $NF = 50$,
 $CD = 25$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача К9.2.

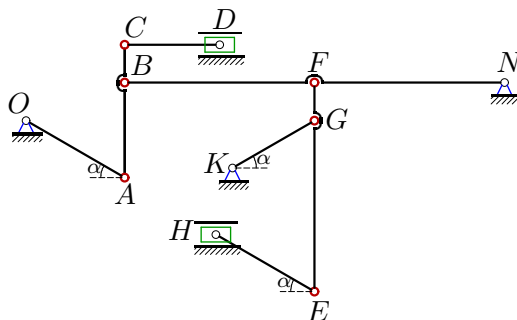
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$\omega_{NB} = 2$ рад/с, $\alpha = 45^\circ$,
 $AB = 20$, $BC = 10$,
 $BF = 80$, $NF = 20$,
 $CD = 15$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача К9.3.

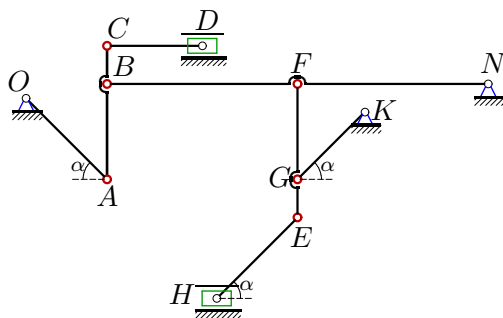
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$\omega_{KG} = 2$ рад/с, $\alpha = 30^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $NF = 50$,
 $CD = 25$, $EH = 30$,
 $FG = 10$, $GE = 45$,
 $OA = 30$, $KG = 25$.
 a_G , a_F , a_E - ?

Задача К9.4.

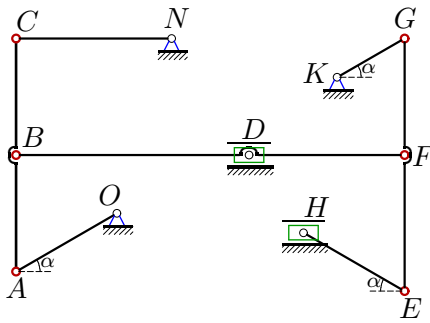
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$\omega_{KG} = 1$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $NF = 50$,
 $CD = 25$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 30$, $KG = 25$.
 a_G , a_F , a_E - ?

Задача K9.5.

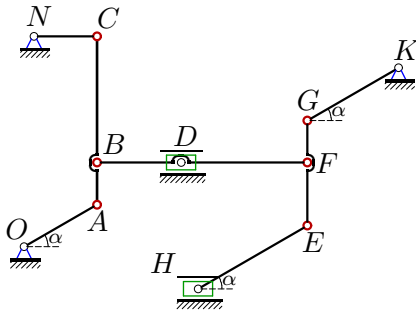
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$\omega_{OA} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $DB = 60, DF = 40,$
 $NC = 40, EH = 30,$
 $FE = 35, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача K9.6.

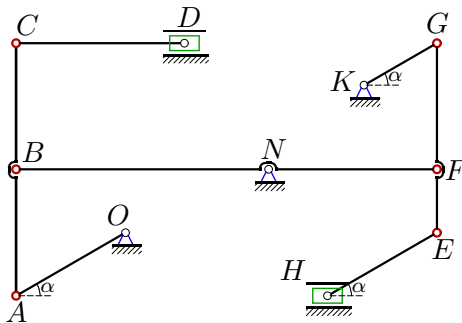
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$\omega_{NC} = 3 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 10, BC = 30,$
 $DB = 20, DF = 30,$
 $NC = 15, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.7.

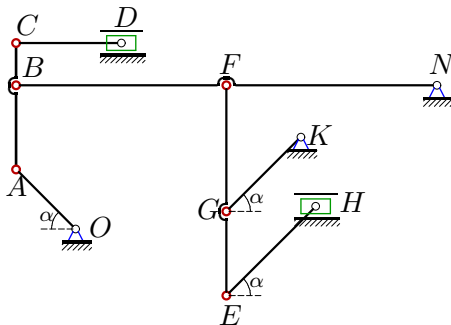
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$\omega_{BF} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 60, NF = 40,$
 $CD = 40, EH = 30,$
 $FE = 15, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача K9.8.

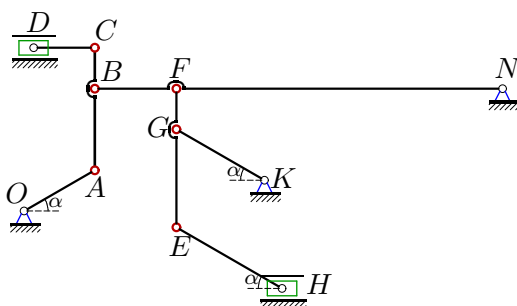
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$\omega_{KG} = 4 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 20, BC = 10,$
 $BF = 50, NF = 50,$
 $CD = 25, EH = 30,$
 $FG = 30, GE = 20,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.9.

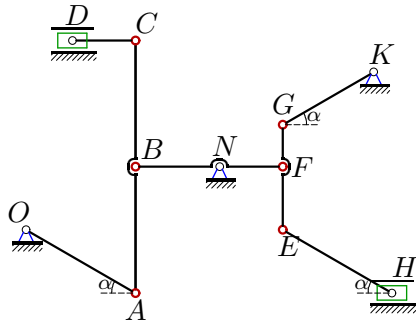
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$\omega_{KG} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 20, NF = 80,$
 $CD = 15, EH = 30,$
 $FG = 10, GE = 24,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.10.

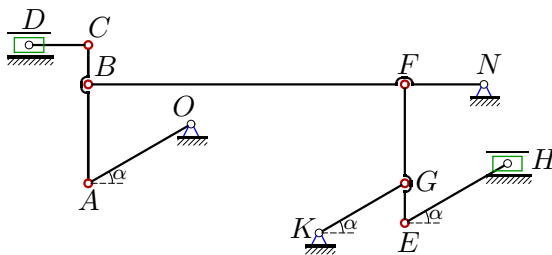
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$\omega_{KG} = 4 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 20, NF = 15,$
 $CD = 15, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 30, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.11.

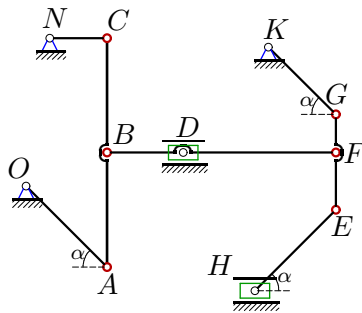
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$\omega_{KG} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 25, BC = 10,$
 $BF = 80, NF = 20,$
 $CD = 15, EH = 30,$
 $FG = 25, GE = 10,$
 $OA = 30, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.12.

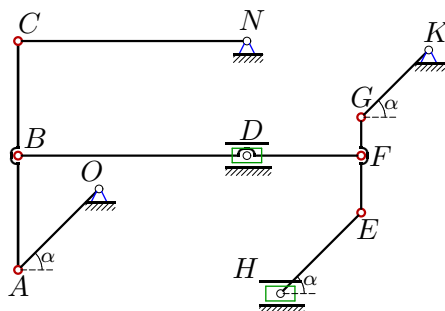
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$\omega_{OA} = 1 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 30, BC = 30,$
 $DB = 20, DF = 40,$
 $NC = 15, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.13.

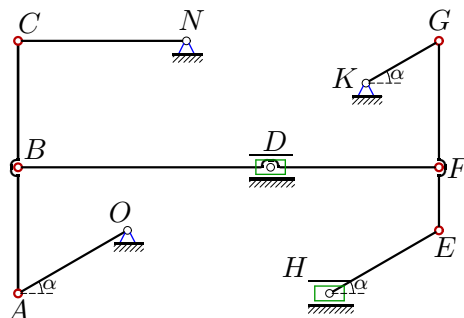
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$\omega_{NC} = 2 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 30, BC = 30,$
 $DB = 60, DF = 30,$
 $NC = 60, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.14.

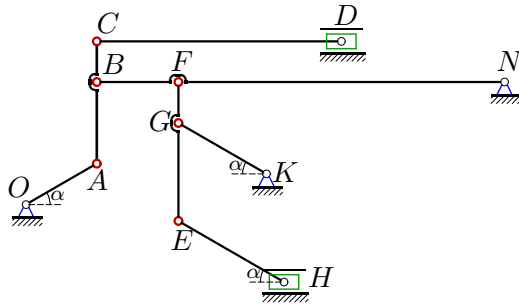
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$\omega_{OA} = 3 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $DB = 60, DF = 40,$
 $NC = 40, EH = 30,$
 $FE = 15, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача K9.15.

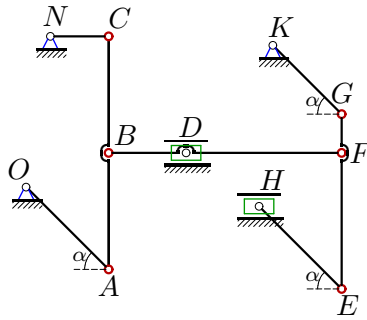
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$\omega_{OA} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 20, NF = 80,$
 $CD = 60, EH = 30,$
 $FG = 10, GE = 24,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.16.

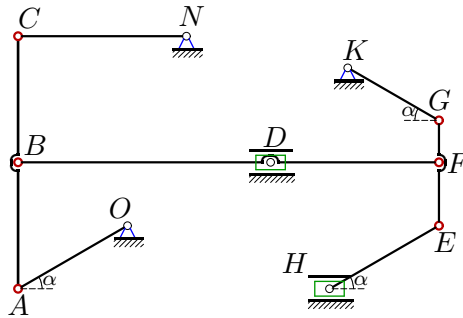
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$\omega_{NC} = 1 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 30, BC = 30,$
 $DB = 20, DF = 40,$
 $NC = 15, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.17.

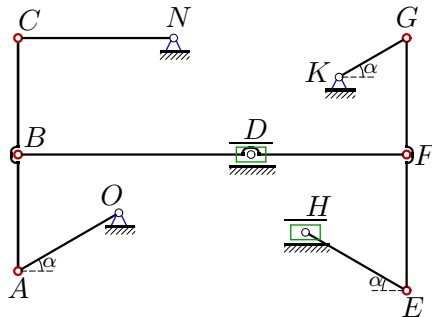
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$\omega_{NC} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $DB = 60, DF = 40,$
 $NC = 40, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.18.

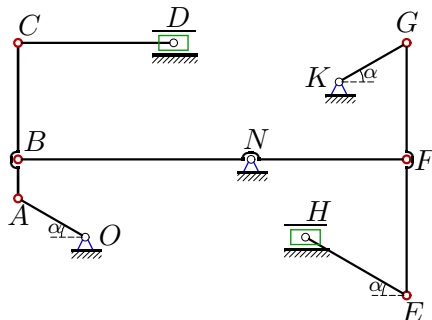
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$\omega_{OA} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $DB = 60, DF = 40,$
 $NC = 40, EH = 30,$
 $FE = 35, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача K9.19.

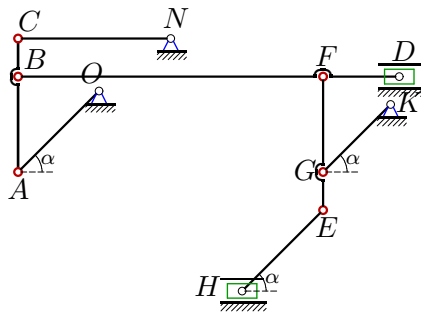
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$\omega_{KG} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 10, BC = 30,$
 $NB = 60, NF = 40,$
 $CD = 40, EH = 30,$
 $FE = 35, FG = 30,$
 $OA = 20, KG = 20.$
 $a_G, a_F, a_E - ?$

Задача K9.20.

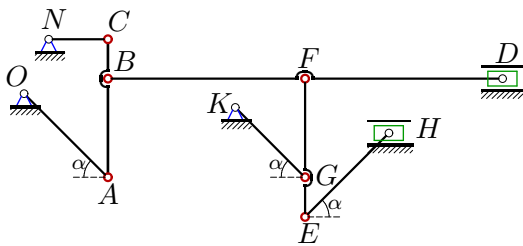
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$\omega_{OA} = 4$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 80$, $FD = 20$,
 $NC = 40$, $EH = 30$,
 $FE = 35$, $FG = 25$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.21.

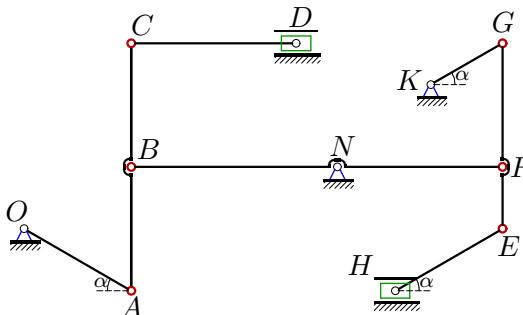
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$\omega_{NC} = 3$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $FD = 50$,
 $NC = 15$, $EH = 30$,
 $FE = 35$, $FG = 25$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.22.

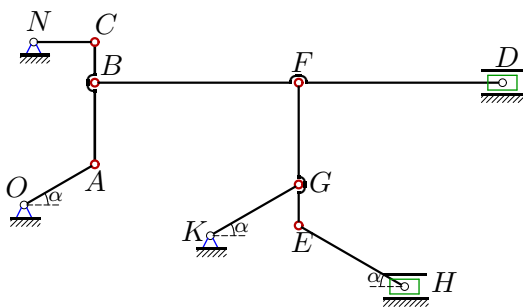
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$\omega_{OA} = 1$ рад/с, $\alpha = 30^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 50$, $NF = 40$,
 $CD = 40$, $EH = 30$,
 $FE = 15$, $FG = 30$,
 $OA = 30$, $KG = 20$.
 a_A , a_B , a_C - ?

Задача K9.23.

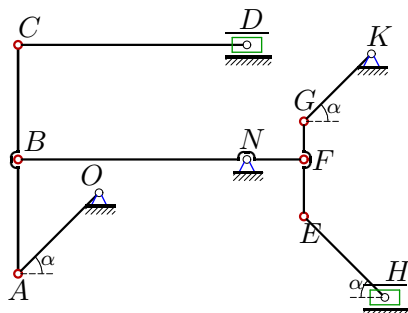
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$\omega_{OA} = 1$ рад/с, $\alpha = 30^\circ$,
 $AB = 20$, $BC = 10$,
 $BF = 50$, $FD = 50$,
 $NC = 15$, $EH = 30$,
 $FE = 35$, $FG = 25$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.24.

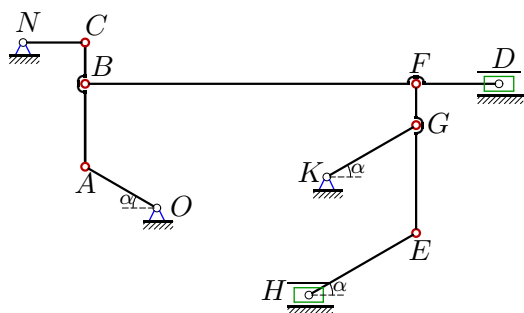
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$\omega_{KG} = 3$ рад/с, $\alpha = 45^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 60$, $NF = 15$,
 $CD = 60$, $EH = 30$,
 $FE = 15$, $FG = 10$,
 $OA = 30$, $KG = 25$.
 a_G , a_F , a_E - ?

Задача K9.25.

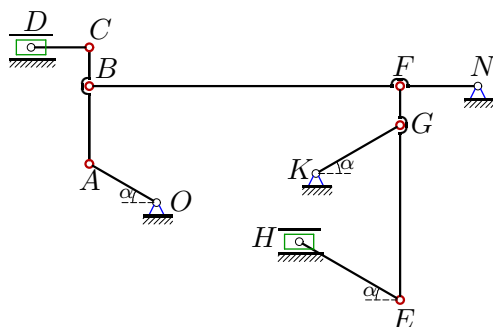
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$\omega_{NC} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 80, FD = 20,$
 $NC = 15, EH = 30,$
 $FE = 36, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.26.

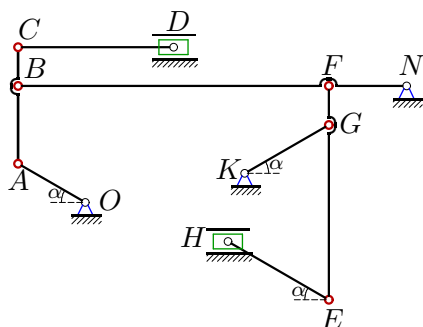
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$\omega_{KG} = 4 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 80, NF = 20,$
 $CD = 15, EH = 30,$
 $FG = 10, GE = 45,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.27.

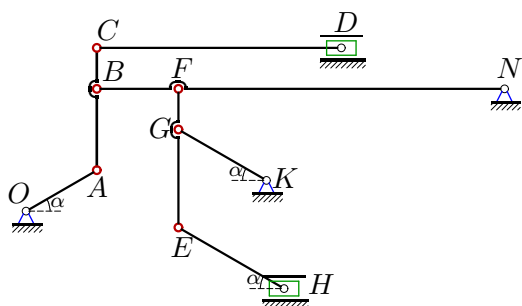
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$\omega_{KG} = 4 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 80, NF = 20,$
 $CD = 40, EH = 30,$
 $FG = 10, GE = 45,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.28.

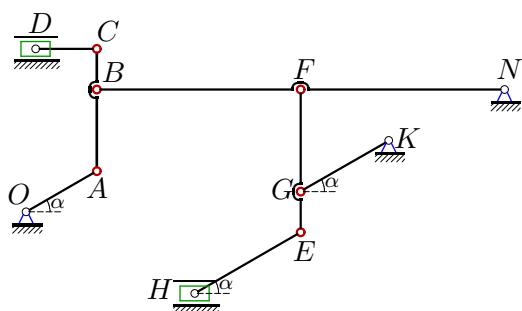
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$\omega_{KG} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 20, NF = 80,$
 $CD = 60, EH = 30,$
 $FG = 10, GE = 24,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача K9.29.

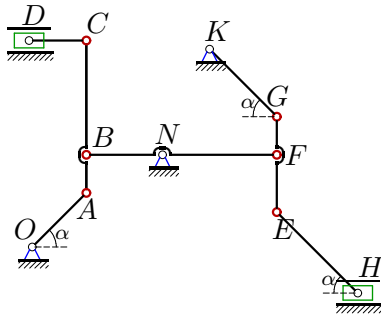
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$\omega_{NB} = 3 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 50, NF = 50,$
 $CD = 15, EH = 30,$
 $FG = 25, GE = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача К9.30.

8



$\omega_{BF} = 1 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 10, BC = 30,$
 $NB = 20, NF = 30,$
 $CD = 15, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

К9 Ответы.
Кинематический анализ механизма (7 звеньев)

04.04.2012

№	v_A	v_B	v_C	v_D	v_E	v_F	v_G	v_H
1	282.843	200.000	215.407	80.000	172.047	100.000	141.421	240.000
2	282.843	200.000	223.607	100.000	68.819	40.000	56.569	96.000
3	100.000	86.603	88.882	20.000	144.157	43.301	50.000	162.500
4	50.000	35.355	38.079	14.142	30.414	17.678	25.000	7.071
5	60.000	54.083	51.962	15.000	65.707	37.749	40.000	35.833
6	51.962	49.038	45.000	19.486	126.656	70.256	77.942	146.142
7	138.564	120.000	138.564	69.282	83.267	80.000	92.376	69.282
8	200.000	141.421	158.114	70.711	137.437	70.711	100.000	47.140
9	31.250	27.063	28.168	7.813	47.697	21.651	25.000	30.000
10	133.333	115.470	133.333	66.667	114.564	86.603	100.000	25.000
11	250.000	216.506	222.205	50.000	55.678	43.301	50.000	10.000
12	30.000	23.717	21.213	10.607	99.640	43.732	60.000	47.730
13	169.706	134.164	120.000	60.000	247.386	84.853	84.853	300.000
14	90.000	81.125	77.942	22.500	71.250	56.624	60.000	78.750
15	20.000	17.321	18.028	5.000	30.526	13.856	16.000	19.200
16	21.213	16.771	15.000	7.500	141.956	30.923	42.426	168.750
17	92.376	83.267	80.000	23.094	54.569	58.119	61.584	42.339
18	60.000	54.083	51.962	15.000	65.707	37.749	40.000	35.833
19	30.000	25.981	51.962	45.000	20.883	17.321	20.000	1.667
20	120.000	88.248	84.853	24.244	22.039	29.593	24.000	2.909
21	63.640	46.801	45.000	12.857	34.655	25.914	31.820	48.857
22	30.000	25.981	30.000	15.000	21.633	20.785	24.000	18.000
23	20.000	17.638	17.321	3.333	10.349	9.280	10.000	10.667
24	300.000	212.132	300.000	212.132	95.607	53.033	75.000	26.517
25	17.321	15.275	15.000	2.887	14.065	4.163	3.464	12.009
26	500.000	433.013	450.694	125.000	288.314	86.603	100.000	325.000
27	500.000	433.013	450.694	125.000	288.314	86.603	100.000	325.000
28	62.500	54.127	56.337	15.625	95.394	43.301	50.000	60.000
29	346.410	300.000	312.250	86.603	192.873	150.000	173.205	34.641
30	28.284	20.000	63.246	60.000	54.083	30.000	42.426	75.000

N_0	ω_{OA}	ω_{CA}	ω_{CD}	ω_{BF}	ω_{FE}	ω_{KG}	ω_{EH}	ω_{NC}	a_A	a_B	a_C	a_E	a_F	a_G
1	-9.428	-8.000	8.000	2.000	4.000	5.657	-4.714	-	26.971	4.000	15.653	-	-	-
2	14.142	-10.000	-13.333	2.000	-1.600	-2.263	-1.886	-	79.137	4.000	33.798	-	-	-
3	3.333	2.000	-3.464	-0.866	-2.500	2.000	1.667	-	-	-	-	6.853	1.186	1.000
4	-1.667	-1.414	1.414	0.354	0.707	1.000	-0.833	-	-	-	-	0.318	0.081	0.250
5	2.000	0.500	-	0.866	1.167	2.000	1.333	1.299	1.200	1.005	0.811	-	-	-
6	2.598	-0.650	-	-2.250	-5.846	3.118	-2.598	3.000	1.665	1.585	1.350	-	-	-
7	4.619	2.309	3.000	2.000	1.540	4.619	3.079	-	6.661	2.400	2.310	-	-	-
8	10.000	-7.071	5.657	1.414	2.357	4.000	3.333	-	-	-	-	5.648	1.533	4.000
9	-1.563	0.781	-1.804	0.271	-1.250	1.000	0.833	-	-	-	-	0.646	0.287	0.250
10	4.444	2.222	7.698	-5.774	-5.000	4.000	3.333	-	-	-	-	19.525	6.727	4.000
11	-8.333	-5.000	14.434	-2.165	-1.000	2.000	-1.667	-	-	-	-	1.637	1.201	1.000
12	1.000	0.354	-	-1.061	5.303	-2.400	-2.000	1.414	0.300	0.310	0.330	-	-	-
13	5.657	2.000	-	2.000	12.000	-3.394	2.828	2.000	11.431	6.893	2.400	-	-	-
14	3.000	0.750	-	1.299	1.750	3.000	2.000	1.949	2.700	2.262	1.825	-	-	-
15	1.000	-0.500	-0.289	-0.173	0.800	-0.640	-0.533	-	0.200	0.153	0.219	-	-	-
16	0.707	0.250	-	-0.750	3.750	-1.697	-1.414	1.000	0.179	0.163	0.150	-	-	-
17	3.079	0.770	-	1.333	-0.770	2.463	2.053	2.000	3.100	2.346	1.600	-	-	-
18	2.000	0.500	-	0.866	1.167	2.000	1.333	1.299	1.200	1.005	0.811	-	-	-
19	1.500	-1.500	0.650	0.433	0.333	1.000	0.667	-	-	-	-	0.048	0.100	0.200
20	4.000	2.424	-	0.849	-0.291	0.960	-0.800	2.121	4.800	2.965	2.242	-	-	-
21	2.121	1.286	-	-0.450	0.386	1.273	-1.061	3.000	1.451	1.355	1.350	-	-	-
22	1.000	0.500	-0.650	-0.520	-0.400	-1.200	-0.800	-	0.300	0.154	0.530	-	-	-
23	1.000	-0.333	-	-0.173	-0.067	0.400	-0.333	1.155	0.200	0.227	0.240	-	-	-
24	-10.000	-7.071	-3.536	-3.536	-5.303	3.000	2.500	-	-	-	-	11.153	4.786	2.250
25	-0.866	0.289	-	-0.150	-0.462	0.139	0.115	1.000	0.189	0.038	0.150	-	-	-
26	-25.000	12.500	28.868	-4.330	-5.000	4.000	3.333	-	-	-	-	37.099	5.858	4.000
27	-25.000	12.500	-10.825	-4.330	-5.000	4.000	3.333	-	-	-	-	37.099	5.858	4.000
28	-3.125	1.563	0.902	0.541	-2.500	2.000	1.667	-	-	-	-	2.583	1.149	1.000
29	-17.321	8.660	-20.000	3.000	3.464	6.928	-5.774	-	79.373	9.000	53.004	-	-	-
30	-1.414	2.000	-1.333	1.000	-3.000	1.697	-1.414	-	1.045	0.200	3.887	-	-	-