

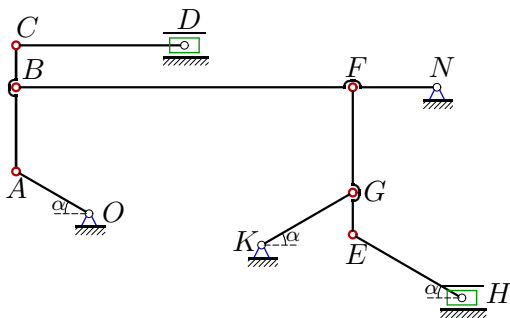
Кинематический анализ механизма (7 звеньев)

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.

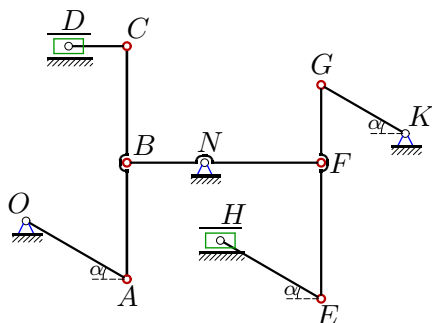
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$\omega_{KG} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 80, NF = 20,$
 $CD = 40, EH = 30,$
 $FG = 25, GE = 10,$
 $OA = 20, KG = 25.$
 $a_G, a_F, a_E - ?$

Задача К9.2.

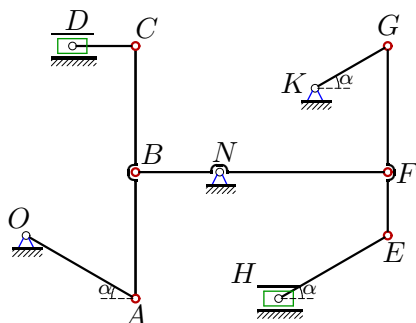
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$\omega_{BF} = 3 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 20, NF = 30,$
 $CD = 15, EH = 30,$
 $FE = 35, FG = 20,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача К9.3.

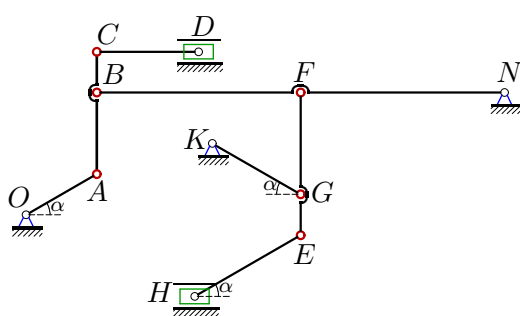
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$\omega_{BF} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 20, NF = 40,$
 $CD = 15, EH = 30,$
 $FE = 15, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача К9.4.

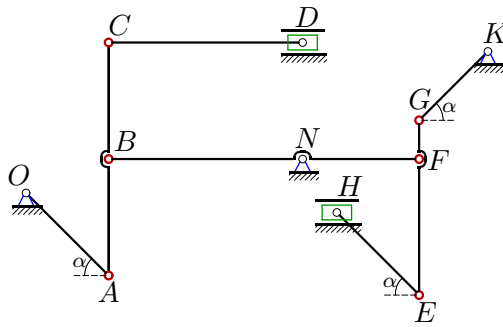
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$\omega_{OA} = 4 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 20, BC = 10,$
 $BF = 50, NF = 50,$
 $CD = 25, EH = 30,$
 $FG = 25, GE = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.5.

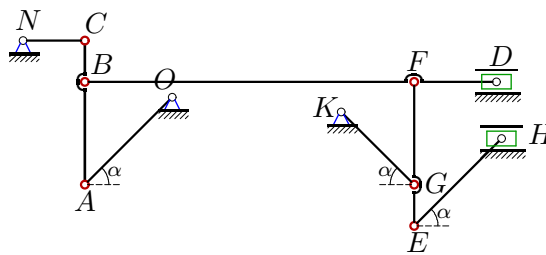
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$\omega_{BF} = 1 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 30, BC = 30,$
 $NB = 50, NF = 30,$
 $CD = 50, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.6.

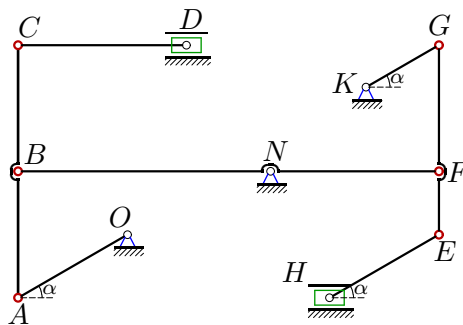
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$\omega_{OA} = 2 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 25, BC = 10,$
 $BF = 80, FD = 20,$
 $NC = 15, EH = 30,$
 $FE = 35, FG = 25,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.7.

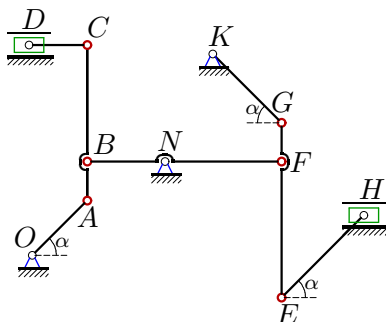
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$\omega_{KG} = 1 \text{ рад/с}, \alpha = 30^\circ,$
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 $NB = 60, NF = 40,$
 $CD = 40, EH = 30,$
 $FE = 15, FG = 30,$
 $OA = 30, KG = 20.$
 $a_G, a_F, a_E - ?$

Задача K9.8.

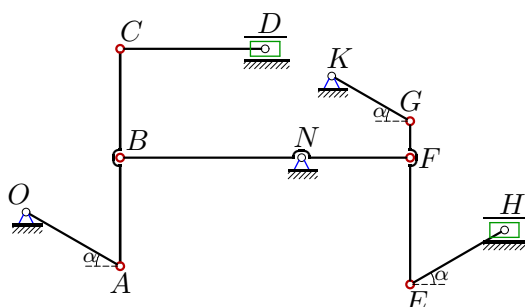
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$\omega_{BF} = 4 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 10, BC = 30,$
 $NB = 20, NF = 30,$
 $CD = 15, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.9.

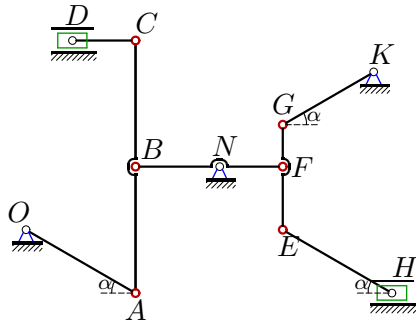
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$\omega_{BF} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 50, NF = 30,$
 $CD = 40, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.10.

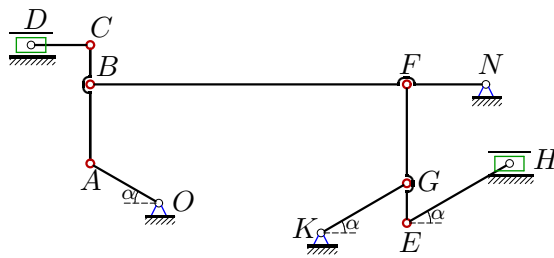
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$\omega_{OA} = 4$ рад/с, $\alpha = 30^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 20$, $NF = 15$,
 $CD = 15$, $EH = 30$,
 $FE = 15$, $FG = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.11.

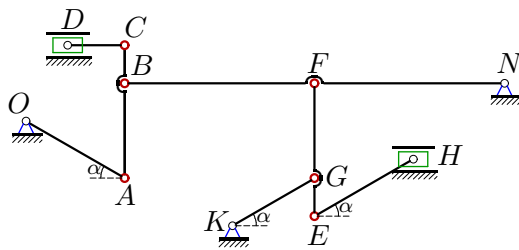
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$\omega_{OA} = 3$ рад/с, $\alpha = 30^\circ$,
 $AB = 20$, $BC = 10$,
 $BF = 80$, $NF = 20$,
 $CD = 15$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.12.

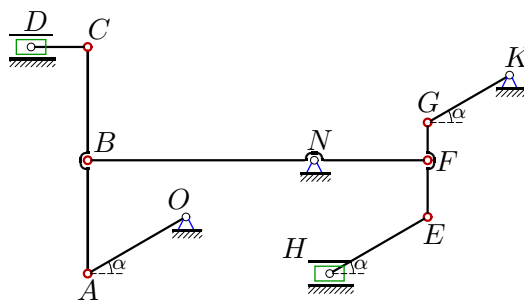
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$\omega_{OA} = 4$ рад/с, $\alpha = 30^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $NF = 50$,
 $CD = 15$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.13.

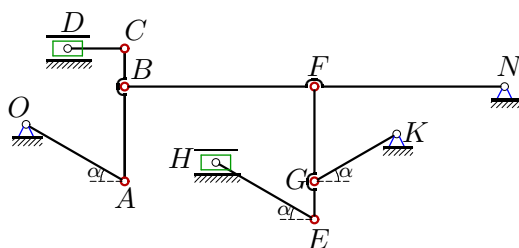
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$\omega_{BF} = 3$ рад/с, $\alpha = 30^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 60$, $NF = 30$,
 $CD = 15$, $EH = 30$,
 $FE = 15$, $FG = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.14.

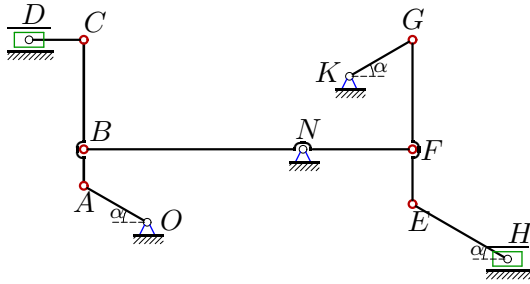
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$\omega_{OA} = 3$ рад/с, $\alpha = 30^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $NF = 50$,
 $CD = 15$, $EH = 30$,
 $FG = 25$, $GE = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.15.

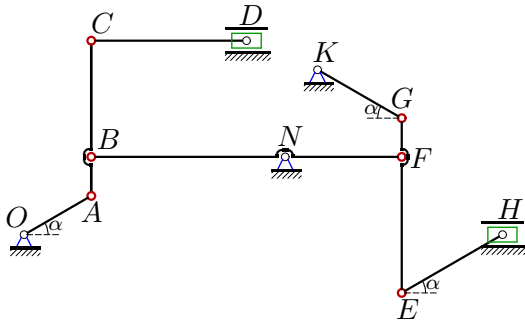
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$\omega_{KG} = 4 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 10, BC = 30,$
 $NB = 60, NF = 30,$
 $CD = 15, EH = 30,$
 $FE = 15, FG = 30,$
 $OA = 20, KG = 20.$
 $a_G, a_F, a_E - ?$

Задача K9.16.

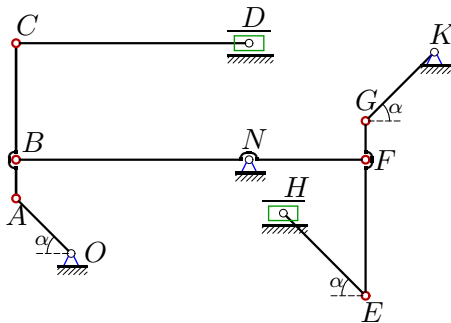
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$\omega_{BF} = 3 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 10, BC = 30,$
 $NB = 50, NF = 30,$
 $CD = 40, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.17.

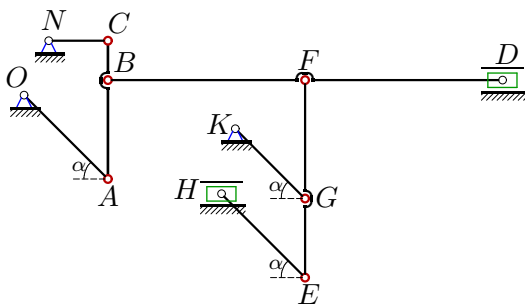
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$\omega_{OA} = 1 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 10, BC = 30,$
 $NB = 60, NF = 30,$
 $CD = 60, EH = 30,$
 $FE = 35, FG = 10,$
 $OA = 20, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.18.

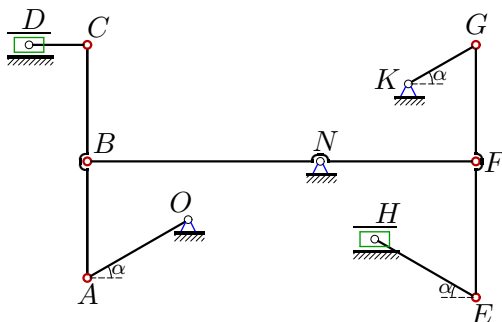
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$\omega_{OA} = 4 \text{ рад/с}, \alpha = 45^\circ,$
 $AB = 25, BC = 10,$
 $BF = 50, FD = 50,$
 $NC = 15, EH = 30,$
 $FE = 50, FG = 30,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

Задача K9.19.

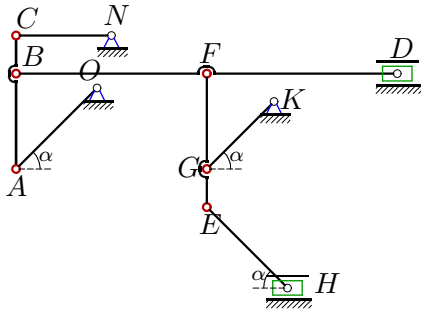
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$\omega_{BF} = 1 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 60, NF = 40,$
 $CD = 15, EH = 30,$
 $FE = 35, FG = 30,$
 $OA = 30, KG = 20.$
 $a_A, a_B, a_C - ?$

Задача K9.20.

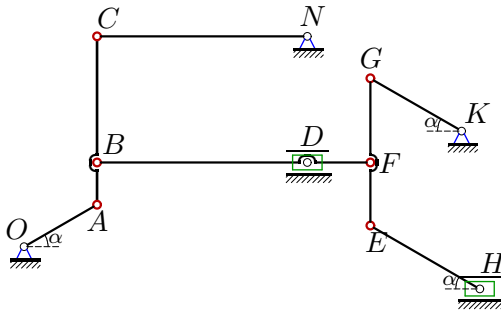
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$\omega_{OA} = 1$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 50$, $FD = 50$,
 $NC = 25$, $EH = 30$,
 $FE = 35$, $FG = 25$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.21.

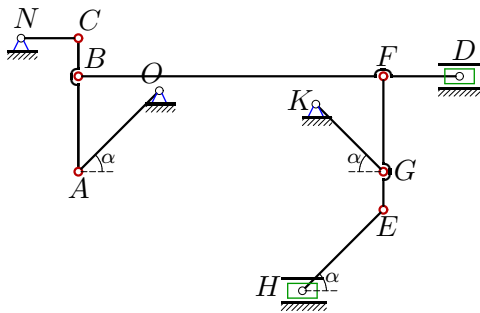
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$\omega_{NC} = 4$ рад/с, $\alpha = 30^\circ$,
 $AB = 10$, $BC = 30$,
 $DB = 50$, $DF = 15$,
 $NC = 50$, $EH = 30$,
 $FE = 15$, $FG = 20$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.22.

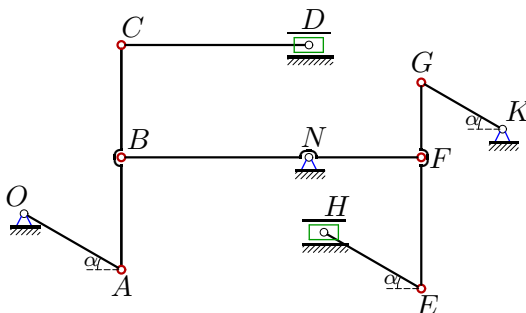
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$\omega_{OA} = 3$ рад/с, $\alpha = 45^\circ$,
 $AB = 25$, $BC = 10$,
 $BF = 80$, $FD = 20$,
 $NC = 15$, $EH = 30$,
 $FE = 35$, $FG = 25$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.23.

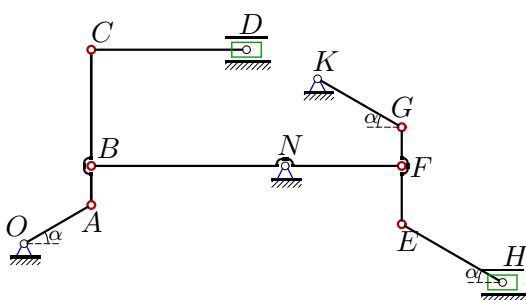
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$\omega_{BF} = 1$ рад/с, $\alpha = 30^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 50$, $NF = 30$,
 $CD = 50$, $EH = 30$,
 $FE = 35$, $FG = 20$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.24.

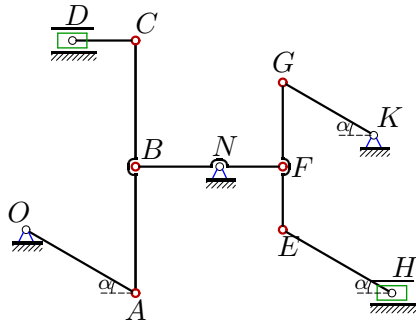
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$\omega_{OA} = 3$ рад/с, $\alpha = 30^\circ$,
 $AB = 10$, $BC = 30$,
 $NB = 50$, $NF = 30$,
 $CD = 40$, $EH = 30$,
 $FE = 15$, $FG = 10$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.25.

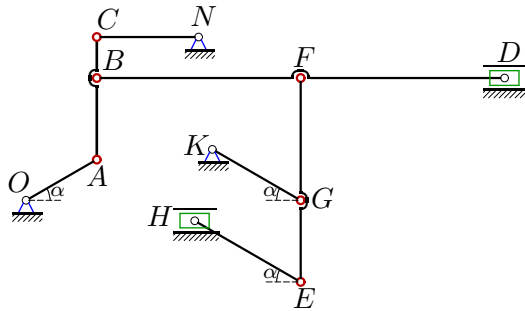
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$\omega_{OA} = 3$ рад/с, $\alpha = 30^\circ$,
 $AB = 30$, $BC = 30$,
 $NB = 20$, $NF = 15$,
 $CD = 15$, $EH = 30$,
 $FE = 15$, $FG = 20$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.26.

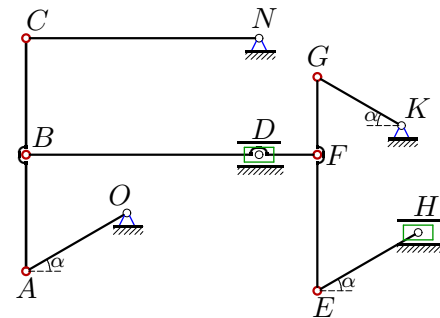
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$\omega_{OA} = 4$ рад/с, $\alpha = 30^\circ$,
 $AB = 20$, $BC = 10$,
 $BF = 50$, $FD = 50$,
 $NC = 25$, $EH = 30$,
 $FE = 50$, $FG = 30$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.27.

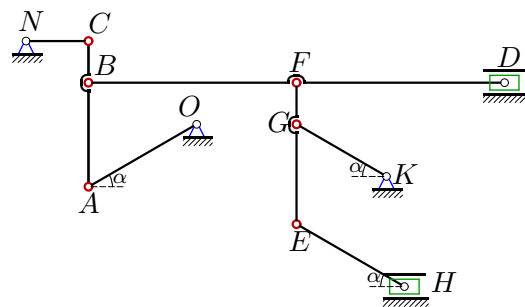
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 $DB = 60$, $DF = 15$,
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 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.28.

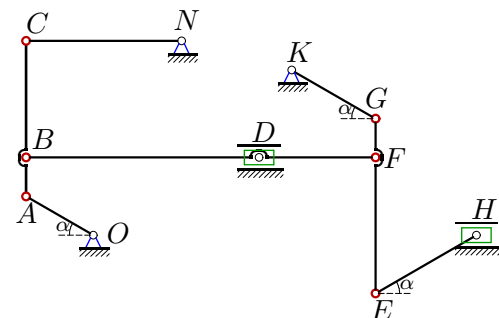
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 $BF = 50$, $FD = 50$,
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 $FE = 34$, $FG = 10$,
 $OA = 30$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача K9.29.

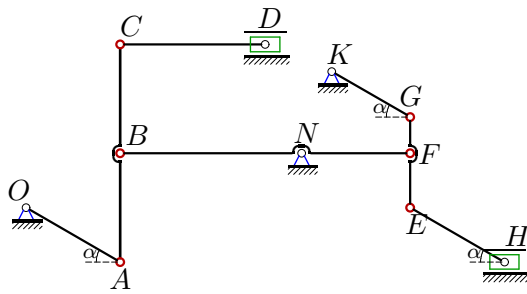
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$\omega_{OA} = 1$ рад/с, $\alpha = 30^\circ$,
 $AB = 10$, $BC = 30$,
 $DB = 60$, $DF = 30$,
 $NC = 40$, $EH = 30$,
 $FE = 35$, $FG = 10$,
 $OA = 20$, $KG = 25$.
 a_A , a_B , a_C - ?

Задача К9.30.

5



$\omega_{BF} = 2 \text{ рад/с}, \alpha = 30^\circ,$
 $AB = 30, BC = 30,$
 $NB = 50, NF = 30,$
 $CD = 40, EH = 30,$
 $FE = 15, FG = 10,$
 $OA = 30, KG = 25.$
 $a_A, a_B, a_C - ?$

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	250.000	216.506	225.347	62.500	55.678	43.301	50.000	60.000
2	69.282	60.000	69.282	34.641	127.940	90.000	103.923	142.894
3	23.094	20.000	23.094	11.547	41.633	40.000	46.188	34.641
4	80.000	69.282	72.111	20.000	44.542	34.641	40.000	48.000
5	70.711	50.000	70.711	50.000	109.202	30.000	42.426	75.000
6	60.000	44.124	42.426	12.122	18.757	14.797	12.000	25.213
7	30.000	25.981	30.000	15.000	18.028	17.321	20.000	15.000
8	113.137	80.000	252.982	240.000	436.807	120.000	169.706	300.000
9	57.735	50.000	57.735	28.868	67.639	30.000	34.641	43.301
10	120.000	103.923	120.000	60.000	103.108	77.942	90.000	22.500
11	60.000	51.962	54.083	15.000	13.363	10.392	12.000	2.400
12	120.000	103.923	106.658	24.000	66.813	51.962	60.000	12.000
13	207.846	180.000	207.846	103.923	119.059	90.000	103.923	129.904
14	90.000	77.942	79.994	18.000	50.110	38.971	45.000	54.000
15	160.000	138.564	277.128	240.000	72.111	69.282	80.000	20.000
16	173.205	150.000	300.000	259.808	202.916	90.000	103.923	129.904
17	20.000	14.142	44.721	42.426	25.739	7.071	10.000	17.678
18	120.000	88.248	84.853	24.244	69.105	48.865	60.000	12.122
19	69.282	60.000	69.282	34.641	48.228	40.000	46.188	3.849
20	30.000	22.062	21.213	6.061	16.336	12.216	15.000	23.031
21	230.940	217.945	200.000	86.603	139.172	105.357	69.282	90.933
22	90.000	66.186	63.640	18.183	28.136	22.195	18.000	37.820
23	57.735	50.000	57.735	28.868	42.647	30.000	34.641	47.631
24	60.000	51.962	103.923	90.000	41.243	31.177	36.000	45.000
25	90.000	77.942	90.000	45.000	63.702	58.457	67.500	59.063
26	80.000	70.553	69.282	13.333	54.614	37.118	40.000	22.222
27	207.846	187.350	180.000	51.962	107.318	68.739	51.962	123.409
28	30.000	26.332	25.981	4.286	38.071	13.679	15.000	28.286
29	20.000	18.875	17.321	7.500	51.977	11.456	10.000	46.250
30	115.470	100.000	115.470	57.735	79.373	60.000	69.282	86.603

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	-12.500	6.250	-5.413	-2.165	-1.000	2.000	-1.667	-	-	-	-	1.637	1.201	1.000
2	-2.309	-1.155	-4.000	3.000	-2.598	-4.157	3.464	-	1.665	1.800	5.232	-	-	-
3	-0.770	-0.385	-1.333	1.000	0.770	2.309	1.540	-	0.185	0.200	0.581	-	-	-
4	4.000	-2.000	-2.771	-0.693	0.800	1.600	1.333	-	3.200	2.448	3.503	-	-	-
5	-2.357	-1.667	1.000	1.000	3.000	-1.697	1.414	-	1.737	0.500	2.658	-	-	-
6	2.000	1.212	-	0.424	-0.824	-0.480	0.400	-2.828	1.200	0.781	1.246	-	-	-
7	1.000	0.500	0.650	0.433	0.333	1.000	0.667	-	-	-	-	0.056	0.100	0.200
8	-5.657	8.000	-5.333	4.000	-12.000	6.788	-5.657	-	16.724	3.200	62.191	-	-	-
9	-1.925	-0.962	1.250	1.000	-1.732	1.386	-1.155	-	1.156	0.500	2.141	-	-	-
10	4.000	2.000	6.928	-5.196	-4.500	3.600	3.000	-	4.800	5.532	14.957	-	-	-
11	3.000	-1.500	-3.464	0.520	0.240	-0.480	0.400	-	1.800	1.377	1.619	-	-	-
12	4.000	2.400	6.928	-1.039	-1.200	2.400	-2.000	-	4.800	1.445	3.198	-	-	-
13	6.928	3.464	-12.000	3.000	5.196	-4.157	3.464	-	14.988	5.400	5.198	-	-	-
14	3.000	1.800	5.196	-0.779	-0.900	-1.800	1.500	-	2.700	0.813	1.799	-	-	-
15	8.000	-8.000	-9.238	2.309	1.333	4.000	-2.667	-	-	-	-	1.292	1.923	3.200
16	-8.660	8.660	3.750	3.000	-5.196	4.157	-3.464	-	22.913	4.500	85.949	-	-	-
17	1.000	-1.414	0.236	0.236	0.707	-0.400	0.333	-	0.200	0.343	0.985	-	-	-
18	4.000	2.424	-	-0.849	0.606	2.400	2.000	5.657	4.800	4.801	4.983	-	-	-
19	2.309	1.155	-4.000	1.000	0.770	2.309	1.540	-	1.665	0.600	0.578	-	-	-
20	1.000	0.606	-	0.212	0.182	0.600	0.500	0.849	0.300	0.224	0.198	-	-	-
21	-11.547	2.887	-	4.000	2.598	-2.771	-2.309	4.000	32.886	22.676	8.000	-	-	-
22	3.000	1.818	-	0.636	-1.236	-0.720	-0.600	-4.243	2.700	1.756	2.803	-	-	-
23	-1.925	-0.962	1.000	1.000	-0.866	-1.386	1.155	-	1.156	0.500	2.141	-	-	-
24	3.000	-3.000	-1.299	-1.039	1.800	-1.440	1.200	-	1.800	1.879	8.185	-	-	-
25	3.000	1.500	5.196	-3.897	1.688	2.700	2.250	-	2.700	3.112	8.413	-	-	-
26	4.000	-1.333	-	-0.693	1.111	1.600	1.333	-2.771	3.200	1.988	2.870	-	-	-
27	6.928	1.732	-	3.000	1.299	-2.078	-1.732	3.000	15.692	10.533	5.400	-	-	-
28	1.000	0.429	-	0.260	-1.179	0.600	0.500	-1.732	0.300	0.268	0.458	-	-	-
29	1.000	-0.250	-	0.289	-1.250	0.400	-0.333	0.433	0.200	0.183	0.146	-	-	-
30	-3.849	-1.925	2.500	2.000	-3.464	2.771	-2.309	-	4.626	2.000	8.563	-	-	-