

Сферическое движение

Твердое тело совершает сферическое движение, заданном углами Эйлера. Найти скорость и ускорение точки, положение которой дано относительно подвижных осей координат.

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова. – М.: ФИЗМАТЛИТ, 2008. – 384 с. (с.222.)

Задача К-15.1.

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$$\psi = 10\sqrt{3t + 10}, \quad \theta = \pi/2,$$
$$\varphi = 3t + (t/2)\cos^2 6t, \quad x = 2, \quad y = 9, \quad z = 4.$$
$$t = 1 \text{ с.}$$

Задача К-15.2.

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$$\psi = \pi/2, \quad \theta = \ln(4t + 2),$$
$$\varphi = t^2 + 2t + 4, \quad x = 1, \quad y = 6, \quad z = 4.$$
$$t = 2 \text{ с.}$$

Задача К-15.3.

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$$\psi = \pi/4, \quad \theta = 5(t + 1)^{1/10},$$
$$\varphi = 14e^{t/2}, \quad x = 1, \quad y = 3, \quad z = 4.$$
$$t = 3 \text{ с.}$$

Задача К-15.4.

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$$\psi = 4 \ln(3t + 2), \quad \theta = \pi/6,$$
$$\varphi = (t/2)\sin 6t + 5t, \quad x = 2, \quad y = 4, \quad z = 3.$$
$$t = 3 \text{ с.}$$

Задача К-15.5.

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$$\psi = 10t + (t)\cos^2 4t, \quad \theta = 12/(3t + 4),$$
$$\varphi = \pi/2, \quad x = 3, \quad y = 8, \quad z = 4.$$
$$t = 3 \text{ с.}$$

Задача К-15.6.

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$$\psi = \pi/6, \quad \theta = 6(t + 1)^{1/10},$$
$$\varphi = 8/(t + 2), \quad x = 1, \quad y = 4, \quad z = 4.$$
$$t = 1 \text{ с.}$$

Задача К-15.7.

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$$\psi = \pi/2, \quad \theta = 12e^{t/2},$$
$$\varphi = 3t + (t/4)\cos^2 8t, \quad x = 1, \quad y = 8, \quad z = 4.$$
$$t = 2 \text{ с.}$$

Задача К-15.8.

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$$\psi = \pi/6, \quad \theta = 8/(t + 2),$$
$$\varphi = 4 \ln(4t + 2), \quad x = 1, \quad y = 4, \quad z = 4.$$
$$t = 2 \text{ с.}$$

Задача К-15.9.

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$$\psi = 19e^{t/3}, \quad \theta = \pi/2,$$
$$\varphi = (t/2)\sin^2 6t - 2t, \quad x = 2, \quad y = 8, \quad z = 2.$$
$$t = 3 \text{ с.}$$

Задача К-15.10.

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$$\psi = \pi/2, \quad \theta = \ln(4t + 2),$$
$$\varphi = t^2 + 2t + 4, \quad x = 1, \quad y = 5, \quad z = 4.$$
$$t = 1 \text{ с.}$$

Задача К-15.11.

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$$\psi = \pi/2, \quad \theta = 2\sqrt{4t + 2},$$
$$\varphi = (t/2)\sin 4t + 2t, \quad x = 1, \quad y = 8, \quad z = 4.$$
$$t = 2 \text{ с.}$$

Задача К-15.12.

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$$\psi = \pi/6, \quad \theta = 15e^{t/2},$$
$$\varphi = (t/2)\sin^2 4t - 5t, \quad x = 1, \quad y = 4, \quad z = 4.$$
$$t = 1 \text{ с.}$$

Задача К-15.13.

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$$\psi = 8t + (t/2)\cos^2 6t, \quad \theta = \pi/2,$$
$$\varphi = 12e^{t/3}, \quad x = 2, \quad y = 6, \quad z = 4.$$
$$t = 1 \text{ с.}$$

Задача К-15.14.

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$$\psi = 18e^{t/3}, \quad \theta = \pi/2,$$
$$\varphi = 3(t + 1)^{1/5}, \quad x = 2, \quad y = 7, \quad z = 2.$$
$$t = 1 \text{ с.}$$

Задача К-15.15.

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$$\psi = \pi/2, \theta = 3t + (t/4) \cos^2 8t,$$

$$\varphi = 3(t+1)^{1/10}, x = 1, y = 9, z = 4.$$

$$t = 1 \text{ с.}$$

Задача К-15.16.

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$$\psi = \pi/2, \theta = (t/2) \sin^2 4t - 2t,$$

$$\varphi = 3(t+1)^{1/10}, x = 1, y = 7, z = 4.$$

$$t = 2 \text{ с.}$$

Задача К-15.17.

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$$\psi = 5 \ln(3t+2), \theta = \pi/2,$$

$$\varphi = \ln(3t+2), x = 2, y = 5, z = 3.$$

$$t = 2 \text{ с.}$$

Задача К-15.18.

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$$\psi = \pi/2, \theta = \ln(4t+2),$$

$$\varphi = 3t + (t/4) \cos^2 8t, x = 1, y = 7, z = 4.$$

$$t = 2 \text{ с.}$$

Задача К-15.19.

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$$\psi = 10\sqrt{3t+10}, \theta = \pi/2,$$

$$\varphi = \ln(3t+2), x = 2, y = 9, z = 4.$$

$$t = 3 \text{ с.}$$

Задача К-15.20.

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$$\psi = 6 \ln(3t+2), \theta = \pi/2,$$

$$\varphi = 2\sqrt{3t+2}, x = 2, y = 6, z = 3.$$

$$t = 3 \text{ с.}$$

Задача К-15.21.

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$$\psi = 16e^{t/4}, \theta = 7(t+1)^{3/10},$$

$$\varphi = \pi/2, x = 3, y = 5, z = 2.$$

$$t = 1 \text{ с.}$$

Задача К-15.22.

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$$\psi = 7 \ln(2t+2), \theta = 11/(3t+4),$$

$$\varphi = \pi/2, x = 3, y = 7, z = 3.$$

$$t = 1 \text{ с.}$$

Задача К-15.23.

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$$\psi = \pi/2, \theta = (t/2) \sin^2 4t - 2t,$$

$$\varphi = 3t + (t/4) \cos^2 8t, x = 1, y = 7, z = 4.$$

$$t = 3 \text{ с.}$$

Задача К-15.24.

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$$\psi = (t/2) \sin 8t + 5t, \theta = 6(t+1)^{3/10},$$

$$\varphi = \pi/6, x = 3, y = 4, z = 1.$$

$$t = 1 \text{ с.}$$

Задача К-15.25.

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$$\psi = \pi/6, \theta = (t/2) \sin 4t + 5t,$$

$$\varphi = 15e^{t/2}, x = 1, y = 4, z = 4.$$

$$t = 3 \text{ с.}$$

Задача К-15.26.

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$$\psi = 10(t+1)^{3/10}, \theta = (t/2) \sin^2 8t - 9t,$$

$$\varphi = \pi/2, x = 3, y = 8, z = 2.$$

$$t = 1 \text{ с.}$$

Задача К-15.27.

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$$\psi = 5(t+1)^{3/10}, \theta = 3 \ln(2t+2),$$

$$\varphi = \pi/4, x = 3, y = 3, z = 2.$$

$$t = 1 \text{ с.}$$

Задача К-15.28.

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$$\psi = 13/(2t+3), \theta = \pi/2,$$

$$\varphi = 3t + (t/2) \cos^2 6t, x = 2, y = 9, z = 2.$$

$$t = 3 \text{ с.}$$

Задача К-15.29.

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$$\psi = \pi/3, \theta = t^2 + 3t + 4,$$

$$\varphi = 13e^{t/2}, x = 1, y = 2, z = 4.$$

$$t = 3 \text{ с.}$$

Задача К-15.30.

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$$\psi = 12e^{t/4}, \theta = 3t + (t) \cos^2 4t,$$

$$\varphi = \pi/2, x = 3, y = 1, z = 2.$$

$$t = 1 \text{ с.}$$

К-15

Ответы.**Сферическое движение**

23.11.2013

	v_x	v_y	v_z	v	a_x	a_y	a_z	a
1	-57.287	14.444	-3.856	59.206	247.963	-257.643	-420.612	347.147
2	-35.141	4.650	1.811	35.494	-47.955	-214.071	18.140	22.501
3	-94.065	30.800	0.416	98.980	-1031.255	-2936.819	11.179	66.790
4	-32.469	14.406	2.439	35.605	-177.722	-226.252	-2.419	70.722
5	-64.902	-18.795	86.267	109.579	219.474	-1437.920	-290.661	115.335
6	2.967	0.255	-0.997	3.141	-2.749	-3.368	1.589	3.384
7	-11.662	-63.247	129.409	144.509	325.443	-2195.619	-910.851	156.939
8	-5.974	-0.354	1.848	6.264	-0.016	-10.806	1.001	1.008
9	68.880	-28.391	44.684	86.874	646.683	-625.386	-1918.719	682.322
10	-21.752	1.990	2.951	22.041	-26.125	-78.143	-17.244	21.628
11	-8.732	2.802	-3.421	9.788	55.185	-32.433	27.122	68.474
12	-37.376	-3.082	12.427	39.508	-178.206	-39.061	-306.617	217.915
13	-52.974	44.303	-39.967	79.789	182.715	-619.127	-754.250	268.667
14	-18.389	5.710	-1.597	19.322	8.161	-3.443	-182.770	22.765
15	-0.393	14.425	-32.358	35.430	1.132	6.550	-328.844	303.378
16	-2.897	-9.972	18.175	20.933	-21.973	-105.924	81.316	124.164
17	-4.614	-4.163	10.014	11.786	-7.695	-15.542	-15.270	4.968
18	-13.194	0.299	2.774	13.486	183.292	-52.358	0.338	185.661
19	-12.585	-8.774	26.033	30.217	-64.612	-60.734	-59.315	7.835
20	-0.816	0.125	0.293	0.876	-1.704	-4.861	10.602	10.291
21	15.181	-18.077	22.421	32.557	-63.901	-146.808	-67.104	36.626
22	2.036	-10.507	22.480	24.897	-3.123	-66.363	-48.652	24.390
23	-26.104	-9.622	23.364	36.330	-141.025	-181.061	22.144	219.460
24	-5.096	3.037	3.141	6.712	55.082	-61.862	37.151	68.644
25	-109.049	42.000	-14.738	117.783	-1274.324	-4527.958	1378.342	1159.264
26	29.322	-0.456	-42.157	51.353	-190.256	-161.993	-385.218	262.786
27	-1.776	-2.467	6.364	7.053	-15.107	3.393	-7.298	7.502
28	-53.150	12.082	-1.221	54.519	-113.532	-312.268	32.550	44.536
29	-93.897	34.243	6.353	100.148	-942.257	-1673.407	-1435.140	1196.186
30	5.611	-8.917	-3.958	11.254	-44.095	-37.458	21.542	22.482

К-15 файл o15k11B

	ω_x	ω_y	ω_z	ω	ε_x	ε_y	ε_z	ε
1	-1.306	-3.950	4.610	6.209	-18.057	6.477	-30.379	35.929
2	0.338	0.215	6.000	6.013	1.153	-2.111	2.000	3.128
3	0.143	0.013	31.372	31.372	0.365	-4.490	15.686	16.320
4	0.482	-0.255	7.926	7.944	-1.915	-3.295	13.260	13.797
5	10.863	0.213	8.219	13.624	-12.575	-0.098	-5.876	13.881
6	-0.286	-0.147	-0.889	0.945	0.259	-0.188	0.593	0.674
7	16.286	0.879	1.897	16.420	9.810	-30.458	-26.695	41.672
8	0.489	0.106	1.600	1.676	-0.074	-0.835	-0.640	1.055
9	9.220	14.539	-4.975	17.920	-69.261	50.720	-4.607	85.970
10	0.503	-0.438	4.000	4.055	-2.087	-1.718	2.000	3.363
11	-0.273	1.235	1.709	2.126	2.165	0.220	-7.915	8.209
12	0.015	-12.365	-3.021	12.729	37.367	-6.137	-2.328	37.939
13	-8.284	-4.870	5.582	11.114	-0.996	61.642	1.861	61.678
14	-2.511	-7.988	0.345	8.381	-3.590	-1.798	-0.138	4.017
15	-3.566	0.263	0.161	3.579	-30.520	2.831	-0.072	30.651
16	2.521	-0.529	0.112	2.578	14.937	-3.427	-0.033	15.325
17	1.638	-0.913	0.375	1.912	-0.957	-0.272	-0.141	1.004
18	0.399	0.022	1.897	1.939	-0.119	-0.766	-26.695	26.706
19	2.330	-2.533	0.273	3.452	-0.875	-0.435	-0.074	0.980
20	0.561	1.537	0.905	1.870	1.237	-0.927	-0.123	1.551
21	3.709	-1.293	-3.553	5.296	-3.666	0.452	-5.682	6.778
22	3.500	0.673	-0.002	3.564	-1.749	-0.577	2.358	2.992
23	3.540	1.413	4.537	5.925	0.106	-18.573	20.485	27.651
24	2.932	2.862	1.989	4.555	-13.368	-22.378	-18.627	32.038
25	-2.097	6.351	33.613	34.272	212.112	74.555	16.806	225.460
26	-1.463	10.152	-1.127	10.318	11.956	61.290	-14.455	64.097
27	0.505	-1.616	-0.485	1.761	-0.851	0.210	1.348	1.608
28	-0.066	0.314	5.975	5.984	1.906	0.254	4.607	4.992
29	-1.278	-8.909	29.131	30.490	-259.806	35.253	14.565	262.591
30	-1.085	0.957	-3.696	3.969	3.267	-4.656	-1.963	6.017