

Сферическое движение

Твердое тел 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, 2002.– 384 с. (с. 222.)

<p>Задача 15.1 $\psi = \pi/2, \theta = 7t + (t/4) \cos^2 8t,$ $\varphi = 7(t+1)^{1/10}, x = 1, y = 5, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.2 $\psi = \pi/1, \theta = (t/2) \sin 4t + 8t,$ $\varphi = t^2 + 8t + 4, x = 1, y = 7, z = 4.$</p> <p>$t = 3 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.3 $\psi = 7 \ln(3t + 2), \theta = \pi/1,$ $\varphi = 7 \ln(3t + 2), x = 2, y = 7, z = 3.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.4 $\psi = 4 \ln(2t + 2), \theta = 6(t + 1)^{3/10},$ $\varphi = \pi/6, x = 3, y = 4, z = 3.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.5 $\psi = 3 \ln(3t + 2), \theta = \pi/4,$ $\varphi = (t/2) \sin 6t + 4t, x = 2, y = 3, z = 3.$</p> <p>$t = 1 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.6 $\psi = 16e^{t/3}, \theta = \pi/2,$ $\varphi = (t/2) \sin^2 6t - 6t, x = 2, y = 5, z = 2.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.7 $\psi = 13/(2t + 3), \theta = \pi/30,$ $\varphi = (t/2) \sin^2 6t - 10t, x = 2, y = 9, z = 2.$</p> <p>$t = 3 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.8 $\psi = 9\sqrt{3t + 9}, \theta = \pi/144,$ $\varphi = (t/2) \sin 6t + 9t, x = 2, y = 8, z = 4.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.9 $\psi = 3t^2 + 10t + 2, \theta = 20e^{t/4},$ $\varphi = \pi/30, x = 3, y = 9, z = 3.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.10 $\psi = (t/2) \sin 6t + 2t, \theta = \pi/2,$ $\varphi = 2\sqrt{3t + 2}, x = 2, y = 1, z = 1.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.11 $\psi = \pi/3, \theta = 10/(t + 2),$ $\varphi = (t/2) \sin 4t + 7t, x = 1, y = 6, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.12 $\psi = 13e^{t/3}, \theta = \pi/3,$ $\varphi = 3\sqrt{3t + 3}, x = 2, y = 2, z = 2.$</p> <p>$t = 2 \text{ с.}$</p> <p><small>15.4</small></p>
<p>Задача 15.13 $\psi = (t/2) \sin 8t + 9t, \theta = 19e^{t/4},$ $\varphi = \pi/144, x = 3, y = 8, z = 1.$</p> <p>$t = 3 \text{ с.}$</p> <p><small>15.4</small></p>	<p>Задача 15.14 $\psi = 4(t + 1)^{1/5}, \theta = \pi/3,$ $\varphi = 4t + (t/2) \cos^2 6t, x = 2, y = 2, z = 2.$</p> <p>$t = 3 \text{ с.}$</p> <p><small>15.4</small></p>

<p>Задача 15.15 $\psi = (t/2) \sin^2 8t - 7t, \theta = 17e^{t/4},$ $\varphi = \pi/3, x = 3, y = 6, z = 3.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.16 $\psi = \pi/144, \theta = 10(t+1)^{1/10},$ $\varphi = 19e^{t/2}, x = 1, y = 8, z = 4.$</p> <p>$t = 2 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.17 $\psi = \pi/2, \theta = 9/(t+2),$ $\varphi = 5 \ln(4t+2), x = 1, y = 5, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.18 $\psi = 3t + (t/2) \cos^2 6t, \theta = \pi/2,$ $\varphi = 3t + (t/2) \cos^2 6t, x = 2, y = 1, z = 4.$</p> <p>$t = 2 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.19 $\psi = (t/2) \sin 8t + 2t, \theta = (t/2) \sin^2 8t - 2t,$ $\varphi = \pi/2, x = 3, y = 1, z = 1.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.20 $\psi = 7(t+1)^{1/5}, \theta = \pi/2,$ $\varphi = 7t + (t/2) \cos^2 6t, x = 2, y = 5, z = 2.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.21 $\psi = 4t + (t) \cos^2 4t, \theta = 4(t+1)^{3/10},$ $\varphi = \pi/3, x = 3, y = 2, z = 4.$</p> <p>$t = 2 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.22 $\psi = \pi/144, \theta = t^2 + 9t + 4,$ $\varphi = 9\sqrt{4t+9}, x = 1, y = 8, z = 4.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.23 $\psi = 4t + (t/2) \cos^2 6t, \theta = \pi/3,$ $\varphi = 4t + (t/2) \cos^2 6t, x = 2, y = 2, z = 4.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.24 $\psi = \pi/2, \theta = (t/2) \sin^2 4t - 6t,$ $\varphi = 6\sqrt{4t+6}, x = 1, y = 5, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.25 $\psi = \pi/1, \theta = 9(t+1)^{1/10},$ $\varphi = 7 \ln(4t+2), x = 1, y = 7, z = 4.$</p> <p>$t = 3 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.26 $\psi = 3t^2 + 2t + 2, \theta = 3(t+1)^{3/10},$ $\varphi = \pi/2, x = 3, y = 1, z = 3.$</p> <p>$t = 2 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.27 $\psi = 14e^{t/3}, \theta = \pi/4,$ $\varphi = 7/(2t+3), x = 2, y = 3, z = 2.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.28 $\psi = \pi/3, \theta = t^2 + 3t + 4,$ $\varphi = 3\sqrt{4t+3}, x = 1, y = 2, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>
<p>Задача 15.29 $\psi = 6\sqrt{3t+6}, \theta = \pi/2,$ $\varphi = 7t + (t/2) \cos^2 6t, x = 2, y = 5, z = 4.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>	<p>Задача 15.30 $\psi = (t/2) \sin^2 6t - 3t, \theta = \pi/3,$ $\varphi = 6/(2t+3), x = 2, y = 2, z = 3.$</p> <p>$t = 1 \text{ с.}$</p> <p>15.4</p>

Сферическое движение

	v_x	v_y	v_z	v	a_x	a_y	a_z	a
1	-30.325	-10.060	20.157	37.777	-257.743	-95.672	-172.757	140.538
2	-73.062	-15.660	45.671	87.574	85.784	-1721.800	1074.397	919.205
3	-0.000	-0.000	0.000	0.000	-0.000	0.000	-0.000	0.000
4	4.310	-5.810	3.437	8.009	-0.552	-7.647	-10.635	1.182
5	-27.334	18.821	-0.598	33.192	-146.653	-196.565	-72.905	41.408
6	59.335	-30.981	18.118	69.345	-80.378	-476.607	-1132.453	485.983
7	119.660	-26.523	-0.308	122.564	-313.291	-1599.681	0.878	40.303
8	-119.998	30.306	-0.614	123.768	-526.451	-1784.928	3.475	73.366
9	60.614	-30.682	31.433	74.856	2324.249	-866.124	-1593.680	1745.139
10	2.611	4.778	-9.999	11.385	-30.937	-22.422	-45.328	25.511
11	-32.681	9.885	-6.657	34.786	-72.173	-198.160	12.766	18.159
12	-24.760	5.415	19.344	31.884	-175.597	-179.616	-153.077	26.096
13	75.735	-36.349	63.585	105.357	679.338	-1566.979	-602.247	703.963
14	-13.785	14.371	-0.586	19.922	-110.420	-91.887	3.866	10.405
15	-16.805	-35.216	87.238	95.567	382.899	-1563.272	-300.713	730.121
16	-208.051	25.544	0.924	209.615	-770.056	-5321.967	-148.207	141.992
17	-14.869	-0.240	4.018	15.405	0.607	-58.985	14.254	9.932
18	17.090	9.769	-10.987	22.543	-173.654	-54.203	-26.671	178.817
19	2.230	6.168	-12.857	14.433	-76.066	135.440	-115.555	154.626
20	-50.538	19.306	2.274	54.147	-222.667	-488.928	-20.984	35.000
21	-16.468	22.279	1.211	27.731	-174.344	77.178	-100.086	162.115
22	-7.921	59.134	-116.287	130.699	-692.542	-1721.362	-654.672	264.954
23	1.786	29.174	-15.480	33.075	-334.432	-152.391	-30.079	156.299
24	-16.982	19.756	-20.450	33.119	-19.632	-145.120	-87.916	67.829
25	-13.620	1.038	1.588	13.752	0.065	-28.737	2.996	2.705
26	5.961	14.360	-10.748	18.901	106.431	-141.765	-178.260	31.395
27	-10.570	-0.986	12.049	16.059	13.076	-95.626	1.418	3.015
28	-24.466	3.931	4.151	25.125	-32.502	-8.542	-145.424	50.316
29	-38.453	6.134	11.558	40.618	16.153	-461.578	156.433	147.893
30	1.230	5.593	-4.548	7.313	14.250	-64.848	15.906	57.124

	ω_x	ω_y	ω_z	ω	ε_x	ε_y	ε_z	ε
1	2.609	-7.112	0.375	7.585	7.885	-29.749	-0.169	30.777
2	7.415	6.234	14.000	17.025	90.567	-101.049	2.000	135.711
3	0.000	-0.000	0.000	0.000	-0.000	-0.000	0.000	0.000
4	1.311	0.603	-0.626	1.573	-0.626	-0.695	-0.774	1.214
5	-0.838	-0.958	8.153	8.252	-6.089	6.341	4.266	9.771
6	6.774	7.876	-8.717	13.561	-66.392	61.670	15.270	91.893
7	-0.033	0.004	-13.295	13.295	-0.040	-0.434	-4.465	4.486
8	-0.068	0.033	15.016	15.017	0.391	0.785	9.310	9.351
9	10.498	21.016	0.271	23.494	2.910	7.969	-181.272	181.470
10	-2.656	3.671	1.061	4.654	-1.767	10.642	-0.199	10.790
11	-1.048	0.369	5.693	5.800	2.799	5.721	6.054	8.787
12	3.012	-6.660	5.720	9.282	-8.986	-6.738	1.157	11.291
13	10.189	5.974	-8.720	14.681	0.967	-70.941	-85.921	111.427
14	-0.078	0.215	7.107	7.111	1.514	0.501	4.580	4.850
15	13.138	-2.804	1.399	13.506	47.160	24.631	-84.062	99.485
16	0.070	-0.365	25.824	25.826	-9.457	-1.695	12.912	16.094
17	0.893	0.449	3.333	3.480	0.902	-3.277	-2.222	4.061
18	0.416	5.702	5.717	8.085	31.483	-17.609	-15.270	39.172
19	2.362	5.073	2.843	6.277	4.093	40.969	34.274	53.572
20	0.323	-0.331	9.975	9.986	-3.362	-3.151	4.607	6.516
21	-2.669	-2.183	3.867	5.182	-15.734	-8.934	24.899	30.779
22	-13.801	5.875	3.928	15.506	21.238	54.994	-0.374	58.954
23	-2.062	5.678	10.463	12.082	38.244	18.134	6.910	42.886
24	-3.990	0.498	3.795	5.529	-0.421	15.431	-0.759	15.455
25	0.240	0.095	2.000	2.017	0.136	-0.502	-0.571	0.773
26	-11.999	-0.417	-7.213	14.006	-8.151	0.097	1.914	8.373
27	4.538	0.783	4.045	6.130	1.074	2.802	1.983	3.597
28	-0.416	-4.983	2.268	5.490	-11.466	-1.050	-0.648	11.532
29	2.771	1.149	8.610	9.117	9.430	-24.051	-30.379	39.878
30	-3.721	-1.447	-2.785	4.868	25.215	7.747	15.573	30.633