

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 $\psi = 7 \ln(2t + 2)$, $\theta = (t/2) \sin^2 8t - 8t$, $\varphi = \pi/1$, $x = 3$, $y = 7$, $z = 3$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.2 $\psi = 6 \ln(3t + 2)$, $\theta = \pi/3$, $\varphi = (t/2) \sin 6t + 7t$, $x = 2$, $y = 6$, $z = 3$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.3 $\psi = (t/2) \sin^2 8t - 6t$, $\theta = 6\sqrt{2t + 6}$, $\varphi = \pi/2$, $x = 3$, $y = 5$, $z = 3$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.4 $\psi = 2t^2 + 3t + 3$, $\theta = \pi/3$, $\varphi = 6/(2t + 3)$, $x = 2$, $y = 2$, $z = 3$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.5 $\psi = 9/(2t + 3)$, $\theta = \pi/2$, $\varphi = 9/(2t + 3)$, $x = 2$, $y = 5$, $z = 2$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.6 $\psi = 2\sqrt{2t + 2}$, $\theta = \ln(2t + 2)$, $\varphi = \pi/2$, $x = 3$, $y = 1$, $z = 4$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.7 $\psi = 10/(3t + 4)$, $\theta = 3t^2 + 7t + 2$, $\varphi = \pi/3$, $x = 3$, $y = 6$, $z = 2$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.8 $\psi = \pi/144$, $\theta = t^2 + 9t + 4$, $\varphi = (t/2) \sin^2 4t - 9t$, $x = 1$, $y = 8$, $z = 4$.</p> <p>$t = 2$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.9 $\psi = \pi/3$, $\theta = 2 \ln(4t + 2)$, $\varphi = 4(t + 1)^{1/10}$, $x = 1$, $y = 2$, $z = 4$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.10 $\psi = (t/2) \sin 6t + 9t$, $\theta = \pi/144$, $\varphi = 10t + (t/2) \cos^2 6t$, $x = 2$, $y = 8$, $z = 1$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.11 $\psi = \pi/3$, $\theta = 2 \ln(4t + 2)$, $\varphi = 4(t + 1)^{1/10}$, $x = 1$, $y = 2$, $z = 4$.</p> <p>$t = 1$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.12 $\psi = (t/2) \sin 8t + 4t$, $\theta = 5(t + 1)^{3/10}$, $\varphi = \pi/4$, $x = 3$, $y = 3$, $z = 1$.</p> <p>$t = 2$ с.</p> <p><small>15.2</small></p>
<p>Задача 15.13 $\psi = 9(t + 1)^{1/5}$, $\theta = \pi/1$, $\varphi = 18e^{t/3}$, $x = 2$, $y = 7$, $z = 2$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>	<p>Задача 15.14 $\psi = 18e^{t/4}$, $\theta = 9t + (t) \cos^2 4t$, $\varphi = \pi/1$, $x = 3$, $y = 7$, $z = 2$.</p> <p>$t = 3$ с.</p> <p><small>15.2</small></p>

<p>Задача 15.15 $\psi = 14e^{t/4}$, $\theta = (t/2) \sin 8t + 4t$, $\varphi = \pi/4$, $x = 3$, $y = 3$, $z = 2$.</p> <p>$t = 3$ с.</p> <p>15.2</p>	<p>Задача 15.16 $\psi = 3t + (t) \cos^2 4t$, $\theta = 5/(3t + 4)$, $\varphi = \pi/2$, $x = 3$, $y = 1$, $z = 4$.</p> <p>$t = 3$ с.</p> <p>15.2</p>
<p>Задача 15.17 $\psi = 7 \ln(3t + 2)$, $\theta = \pi/1$, $\varphi = (t/2) \sin 6t + 8t$, $x = 2$, $y = 7$, $z = 3$.</p> <p>$t = 2$ с.</p> <p>15.2</p>	<p>Задача 15.18 $\psi = 4t + (t/2) \cos^2 6t$, $\theta = \pi/3$, $\varphi = 4t + (t/2) \cos^2 6t$, $x = 2$, $y = 2$, $z = 4$.</p> <p>$t = 3$ с.</p> <p>15.2</p>
<p>Задача 15.19 $\psi = 8/(2t + 3)$, $\theta = \pi/6$, $\varphi = 6t + (t/2) \cos^2 6t$, $x = 2$, $y = 4$, $z = 2$.</p> <p>$t = 1$ с.</p> <p>15.2</p>	<p>Задача 15.20 $\psi = (t/2) \sin 6t + 10t$, $\theta = \pi/30$, $\varphi = 2t^2 + 10t + 3$, $x = 2$, $y = 9$, $z = 1$.</p> <p>$t = 2$ с.</p> <p>15.2</p>
<p>Задача 15.21 $\psi = (t/2) \sin 6t + 10t$, $\theta = \pi/30$, $\varphi = 11t + (t/2) \cos^2 6t$, $x = 2$, $y = 9$, $z = 1$.</p> <p>$t = 3$ с.</p> <p>15.2</p>	<p>Задача 15.22 $\psi = \pi/144$, $\theta = 19e^{t/2}$, $\varphi = t^2 + 9t + 4$, $x = 1$, $y = 8$, $z = 4$.</p> <p>$t = 3$ с.</p> <p>15.2</p>
<p>Задача 15.23 $\psi = 7\sqrt{3t + 7}$, $\theta = \pi/3$, $\varphi = (t/2) \sin^2 6t - 7t$, $x = 2$, $y = 6$, $z = 4$.</p> <p>$t = 2$ с.</p> <p>15.2</p>	<p>Задача 15.24 $\psi = 8\sqrt{3t + 8}$, $\theta = \pi/1$, $\varphi = 18e^{t/3}$, $x = 2$, $y = 7$, $z = 4$.</p> <p>$t = 1$ с.</p> <p>15.2</p>
<p>Задача 15.25 $\psi = 9t + (t/2) \cos^2 6t$, $\theta = \pi/1$, $\varphi = 11/(2t + 3)$, $x = 2$, $y = 7$, $z = 4$.</p> <p>$t = 2$ с.</p> <p>15.2</p>	<p>Задача 15.26 $\psi = 5 \ln(2t + 2)$, $\theta = 7(t + 1)^{3/10}$, $\varphi = \pi/2$, $x = 3$, $y = 5$, $z = 3$.</p> <p>$t = 1$ с.</p> <p>15.2</p>
<p>Задача 15.27 $\psi = 3(t + 1)^{3/10}$, $\theta = 3t^2 + 2t + 2$, $\varphi = \pi/2$, $x = 3$, $y = 1$, $z = 2$.</p> <p>$t = 3$ с.</p> <p>15.2</p>	<p>Задача 15.28 $\psi = 7/(2t + 3)$, $\theta = \pi/4$, $\varphi = 7/(2t + 3)$, $x = 2$, $y = 3$, $z = 2$.</p> <p>$t = 2$ с.</p> <p>15.2</p>
<p>Задача 15.29 $\psi = 16e^{t/3}$, $\theta = \pi/2$, $\varphi = (t/2) \sin^2 6t - 6t$, $x = 2$, $y = 5$, $z = 2$.</p> <p>$t = 2$ с.</p> <p>15.2</p>	<p>Задача 15.30 $\psi = (t/2) \sin^2 6t - 9t$, $\theta = \pi/144$, $\varphi = (t/2) \sin 6t + 9t$, $x = 2$, $y = 8$, $z = 3$.</p> <p>$t = 3$ с.</p> <p>15.2</p>

Сферическое движение

	v_x	v_y	v_z	v	a_x	a_y	a_z	a
1	1.638	-23.920	54.174	59.243	449.385	-769.972	177.320	544.450
2	-62.245	18.258	4.981	65.058	-279.070	-802.008	379.206	212.250
3	-21.358	35.130	-37.192	55.440	-195.096	-198.456	-498.662	287.584
4	0.550	-10.911	6.907	12.925	55.256	-39.120	-66.441	8.175
5	0.871	-0.070	-0.695	1.116	-0.402	-0.346	0.643	0.705
6	-2.183	-3.382	2.483	4.730	0.916	-3.837	-5.320	2.043
7	-19.088	-15.119	73.989	77.893	-823.076	-497.481	-306.618	10.932
8	25.998	-21.523	36.547	49.747	-439.299	-859.887	1210.906	1095.323
9	2.040	0.383	-0.702	2.191	-1.008	-0.176	-0.860	0.746
10	-191.542	48.130	-1.959	197.506	-1295.040	-4553.190	6.835	146.314
11	4.430	2.415	-2.315	5.551	-5.903	-2.929	-4.762	4.147
12	-0.816	-0.167	2.949	3.065	-18.456	15.699	-1.123	24.563
13	-110.011	31.432	-0.000	114.414	-532.867	-1717.819	-0.000	40.443
14	46.263	1.065	-73.121	86.534	1043.671	-1521.332	15.124	730.758
15	-28.630	12.517	24.169	39.503	-376.499	-59.964	-125.567	178.399
16	-5.783	8.477	2.218	10.499	-39.640	-55.548	16.061	19.759
17	-55.346	15.813	0.000	57.561	-199.526	-416.311	-0.000	77.480
18	1.786	29.174	-15.480	33.075	-334.432	-152.391	-30.079	156.299
19	-28.852	14.224	0.404	32.170	20.622	-258.707	-20.663	133.515
20	-272.968	61.455	-7.160	279.892	-1992.678	-8313.139	464.093	203.284
21	-233.303	50.562	11.545	238.998	-1492.219	-6015.702	5.650	184.267
22	-246.896	128.582	-195.441	340.129	5895.708	-7290.862	-15814.220	5024.157
23	52.363	-6.829	-15.937	55.159	-252.678	-414.885	-11.956	193.650
24	-33.289	9.511	-0.000	34.621	-68.223	-151.737	0.000	23.912
25	85.160	-24.331	0.000	88.568	-404.698	-1004.978	-0.000	113.038
26	4.770	-10.604	12.904	17.370	-26.321	-26.534	-30.025	19.786
27	-39.692	-0.633	59.854	71.822	-1212.249	42.173	-781.882	28.537
28	1.245	-0.635	-0.292	1.428	-1.087	-0.356	0.601	0.934
29	59.335	-30.981	18.118	69.345	-80.378	-476.607	-1132.453	485.983
30	7.870	-1.202	-2.042	8.219	-63.892	10.469	-7.842	66.025

	ω_x	ω_y	ω_z	ω	ε_x	ε_y	ε_z	ε
1	9.152	3.296	1.178	9.798	61.290	9.136	-30.750	69.177
2	1.701	2.613	11.681	12.089	24.795	-18.375	3.949	31.113
3	-8.478	-1.732	3.232	9.237	-32.683	0.144	29.279	43.880
4	5.650	2.197	3.020	6.773	2.174	3.967	2.384	5.114
5	-0.187	-0.120	-0.222	0.314	0.110	0.012	0.099	0.148
6	0.983	-0.500	0.183	1.118	-0.154	0.250	-0.537	0.612
7	6.785	-11.094	-0.517	13.014	-3.060	-8.695	-3.828	9.981
8	2.987	-12.652	-9.576	16.146	121.615	26.655	-15.323	125.441
9	-0.067	0.567	0.115	0.583	0.084	-0.154	-0.026	0.178
10	-0.223	0.087	23.954	23.955	0.858	3.002	18.121	18.388
11	-0.550	1.215	0.214	1.350	0.627	-0.692	-0.096	0.939
12	0.566	-0.417	0.133	0.716	3.990	4.219	7.155	9.215
13	-0.000	0.000	15.716	15.716	0.000	0.000	5.555	5.555
14	-12.622	-5.078	-8.060	15.814	13.574	100.466	-66.117	121.034
15	-0.434	-8.490	3.883	9.346	35.018	-5.964	36.920	51.233
16	2.485	0.089	6.139	6.623	-5.638	-0.041	-12.362	13.587
17	-0.000	-0.000	7.907	7.907	-0.000	0.000	10.643	10.643
18	-2.062	5.678	10.463	12.082	38.244	18.134	6.910	42.886
19	-0.057	-0.315	7.055	7.063	-2.351	0.683	-29.935	30.035
20	-0.529	1.198	30.463	30.491	21.160	10.450	13.605	27.241
21	1.219	-0.287	25.891	25.921	-2.637	-17.360	18.050	25.182
22	-28.396	-31.724	15.000	45.141	-490.057	410.072	2.000	638.999
23	-2.423	0.700	-8.261	8.637	-6.519	-23.625	15.102	28.787
24	-0.000	0.000	4.756	4.756	0.000	-0.000	3.285	3.285
25	0.000	-0.000	-12.166	12.166	-0.000	0.000	15.527	15.527
26	1.805	-1.293	-1.730	2.814	-3.138	0.452	-1.469	3.494
27	-0.146	-20.000	-0.308	20.003	-6.138	-6.000	2.974	9.084
28	-0.170	-0.109	-0.488	0.528	0.128	0.014	0.279	0.307
29	6.774	7.876	-8.717	13.561	-66.392	61.670	15.270	91.893
30	-0.260	-0.021	-0.992	1.025	-0.327	2.852	8.912	9.363