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. *14*

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

$t = 2\ c.$

Задача К-15.2. *14*

$\psi = 2t^2 + 10t + 3,\ \theta = \pi/2,$
$\varphi = 5/(2t+3),\ \ x = 2,\ y = 9,\ z = 3.$

$t = 1\ c.$

Задача К-15.3. *14*

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

$t = 1\ c.$

Задача К-15.4. *14*

$\psi = \pi/2,\ \theta = 2\sqrt{4t+2},$
$\varphi = (t/2)\sin 4t + 2t,\ \ x = 1,\ y = 9,\ z = 4.$

$t = 1\ c.$

Задача К-15.5. *14*

$\psi = 8\ln(3t+2),\ \theta = \pi/2,$
$\varphi = 5/(2t+3),\ \ x = 2,\ y = 8,\ z = 3.$

$t = 2\ c.$

Задача К-15.6. *14*

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

$t = 3\ c.$

Задача К-15.7. *14*

$\psi = 6t + (t)\cos^2 4t,\ \theta = 8/(3t+4),$
$\varphi = \pi/6,\ \ x = 3,\ y = 4,\ z = 4.$

$t = 1\ c.$

Задача К-15.8. *14*

$\psi = \pi/4,\ \theta = (t/2)\sin 4t + 4t,$
$\varphi = 7/(t+2),\ \ x = 1,\ y = 3,\ z = 4.$

$t = 2\ c.$

Задача К-15.9. *14*

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

$t = 2\ c.$

Задача К-15.10. *14*

$\psi = 3t^2 + 6t + 2,\ \theta = (t/2)\sin^2 8t - 6t,$
$\varphi = \pi/2,\ \ x = 3,\ y = 5,\ z = 3.$

$t = 2\ c.$

Задача К-15.11. *14*

$\psi = 12e^{t/4},\ \theta = 5/(3t+4),$
$\varphi = \pi/2,\ \ x = 3,\ y = 1,\ z = 2.$

$t = 1\ c.$

Задача К-15.12. *14*

$\psi = (t/2)\sin 6t + 8t,\ \theta = \pi/2,$
$\varphi = (t/2)\sin 6t + 2t,\ \ x = 2,\ y = 7,\ z = 1.$

$t = 2\ c.$

Задача К-15.13. *14*

$\psi = 7\ln(3t+2),\ \theta = \pi/2,$
$\varphi = 5/(2t+3),\ \ x = 2,\ y = 7,\ z = 3.$

$t = 2\ c.$

Задача К-15.14. *14*

$\psi = \pi/2,\ \theta = 3(t+1)^{1/10},$
$\varphi = 12e^{t/2},\ \ x = 1,\ y = 7,\ z = 4.$

$t = 3\ c.$

Задача К-15.15. *14*

$\psi = 2t^2 + 10t + 3,\ \theta = \pi/2,$
$\varphi = 2\sqrt{3t+2},\ \ x = 2,\ y = 9,\ z = 3.$

$t = 2\ c.$

Задача К-15.16. *14*

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

$t = 3\ c.$

Задача К-15.17. *14*

$\psi = \pi/6,\ \theta = 6t + (t/4)\cos^2 8t,$
$\varphi = t^2 + 5t + 4,\ \ x = 1,\ y = 4,\ z = 4.$

$t = 3\ c.$

Задача К-15.18. *14*

$\psi = \pi/4,\ \theta = 5t + (t/4)\cos^2 8t,$
$\varphi = (t/2)\sin 4t + 4t,\ \ x = 1,\ y = 3,\ z = 4.$

$t = 1\ c.$

Задача К-15.19. *14*

$\psi = \pi/2,\ \theta = 5/(t+2),$
$\varphi = 12e^{t/2},\ \ x = 1,\ y = 5,\ z = 4.$

$t = 2\ c.$

Задача К-15.20. *14*

$\psi = 2t^2 + 2t + 3,\ \theta = \pi/2,$
$\varphi = 2\sqrt{3t+2},\ \ x = 2,\ y = 1,\ z = 3.$

$t = 1\ c.$

Задача К-15.21. *14*

$\psi = 17e^{t/3},\ \theta = \pi/2,$
$\varphi = (t/2)\sin 6t + 2t,\ \ x = 2,\ y = 6,\ z = 2.$

$t = 1\ c.$

Задача К-15.22. *14*

$\psi = (t/2)\sin 6t + 7t,\ \theta = \pi/2,$
$\varphi = (t/2)\sin 6t + 2t,\ \ x = 2,\ y = 6,\ z = 1.$

$t = 1\ c.$

Задача К-15.23. *14*

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

$t = 3\ c.$

Задача К-15.24. *14*

$\psi = (t/2)\sin^2 6t - 4t,\ \theta = \pi/4,$
$\varphi = 7/(2t+3),\ \ x = 2,\ y = 3,\ z = 3.$

$t = 1\ c.$

Задача К-15.25. *14*

$\psi = 13/(3t+4),\ \theta = 20e^{t/4},$
$\varphi = \pi/2,\ \ x = 3,\ y = 9,\ z = 2.$

$t = 1\ c.$

Задача К-15.26. *14*

$\psi = 11(t+1)^{1/5},\ \theta = \pi/2,$
$\varphi = 3t + (t/2)\cos^2 6t,\ \ x = 2,\ y = 9,\ z = 2.$

$t = 3\ c.$

Задача К-15.27. *14*

$\psi = (t/2)\sin^2 8t - 8t,\ \theta = 9t + (t)\cos^2 4t,$
$\varphi = \pi/2,\ \ x = 3,\ y = 7,\ z = 3.$

$t = 2\ c.$

Задача К-15.28. *14*

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

$t = 2\ c.$

Задача К-15.29. *14*

$\psi = \pi/2,\ \theta = 3(t+1)^{1/10},$
$\varphi = (t/2)\sin^2 4t - 2t,\ \ x = 1,\ y = 9,\ z = 4.$

$t = 2\ c.$

Задача К-15.30. *14*

$\psi = 5\ln(2t+2),\ \theta = 9/(3t+4),$
$\varphi = \pi/2,\ \ x = 3,\ y = 5,\ z = 3.$

$t = 1\ c.$

Ответы.

Сферическое движение

23.11.2013

	v_x	v_y	v_z	v	a_x	a_y	a_z	a
1	-8.732	2.802	-3.421	9.788	55.185	-32.433	27.122	68.474
2	26.293	-36.142	90.897	101.291	690.849	-1081.717	-635.341	20.713
3	0.375	16.117	-20.240	25.876	-5.039	-72.965	-74.929	13.516
4	-12.758	1.024	0.885	12.830	-54.238	1.699	-31.412	54.158
5	8.433	-6.304	11.189	15.363	21.795	-19.877	-40.201	9.775
6	-154.725	43.787	-26.999	163.052	-818.532	-4362.785	102.289	414.271
7	4.027	0.523	-3.543	5.389	-5.986	4.633	-7.404	1.191
8	-13.286	2.207	1.666	13.571	24.224	-4.897	-48.424	31.664
9	-62.266	5.127	11.722	63.567	-394.733	-1087.749	-95.697	315.576
10	-62.498	13.490	40.014	75.426	-427.325	-1045.095	272.786	488.669
11	-2.298	3.685	1.605	4.630	-12.258	-5.719	10.528	5.439
12	-40.471	14.924	-23.522	49.132	89.124	-256.903	-793.854	361.432
13	7.379	-5.567	8.070	12.270	12.875	-12.001	-30.769	7.647
14	-188.105	27.211	-0.593	190.064	-817.242	-5048.230	7.614	86.185
15	34.204	33.775	-124.127	133.110	-1800.922	-1313.176	-765.926	107.605
16	-16.306	-11.768	24.671	31.829	57.923	-256.022	180.294	216.865
17	-52.167	40.019	-26.977	71.068	-96.119	-598.836	-639.792	414.364
18	2.221	22.475	-17.412	28.518	-13.641	6.916	-205.091	154.177
19	-80.382	16.759	-0.853	82.115	-307.612	-1322.195	43.942	42.219
20	-5.625	20.166	-2.972	21.146	-1.809	-8.271	-145.087	33.139
21	-33.798	-5.398	49.992	60.586	-192.183	-516.815	-92.679	111.796
22	-32.104	0.292	62.457	70.226	-255.417	-729.109	-46.161	90.284
23	-214.704	27.954	-2.233	216.528	-830.991	-5772.088	30.821	80.668
24	11.557	2.674	-10.378	15.762	-42.302	-113.665	59.055	89.501
25	-6.725	-1.209	15.530	16.967	-132.928	28.751	-73.922	48.386
26	-55.199	11.653	2.761	56.483	-114.547	-312.480	-74.439	59.392
27	-3.034	-24.560	60.341	65.219	-749.980	-30.159	-597.471	511.320
28	-6.936	-8.327	13.876	17.607	-16.503	-31.338	-30.075	4.199
29	23.021	-2.159	-0.897	23.140	131.353	-75.254	2.622	137.803
30	-1.862	-5.088	10.342	11.676	3.007	-18.450	-17.698	11.859

K-15 файл o15k14B

	ω_x	ω_y	ω_z	ω	ε_x	ε_y	ε_z	ε
1	-0.273	1.235	1.709	2.126	2.165	0.220	-7.915	8.209
2	11.781	7.564	-0.400	14.006	0.340	6.873	0.320	6.889
3	-3.989	0.295	0.161	4.003	-1.947	0.789	-0.072	2.102
4	-0.083	-1.631	0.693	1.774	-1.102	0.601	6.054	6.183
5	1.965	2.267	-0.204	3.007	-1.200	-0.449	0.117	1.286
6	-4.224	1.654	26.890	27.270	25.401	121.059	13.445	124.424
7	0.505	1.854	0.848	2.100	2.274	3.099	2.842	4.781
8	-0.661	-3.650	-0.438	3.735	3.007	7.499	0.219	8.082
9	3.475	-1.296	19.028	19.386	-32.069	-63.364	9.514	71.652
10	10.279	3.794	14.776	18.396	-52.639	-53.390	43.928	86.897
11	2.523	0.306	2.910	3.864	-0.260	-0.262	1.500	1.545
12	-5.860	-8.750	4.532	11.465	-45.027	18.532	9.658	49.641
13	1.720	1.983	-0.204	2.633	-1.050	-0.393	0.117	1.127
14	-0.080	0.031	26.890	26.890	0.863	2.150	13.445	13.643
15	-10.551	14.583	1.061	18.031	13.123	14.432	-0.199	19.507
16	3.864	2.377	3.688	5.846	26.213	-3.517	4.293	26.794
17	-7.255	-2.042	11.000	13.334	-42.177	74.252	2.000	85.418
18	-4.946	2.575	2.693	6.192	-20.249	27.469	6.054	34.658
19	-0.112	0.292	16.310	16.313	4.813	1.685	8.155	9.618
20	-5.828	-1.428	1.342	6.148	-5.801	6.867	-0.402	8.998
21	7.579	-2.258	4.881	9.293	-8.492	-37.744	5.029	39.013
22	9.469	-2.821	4.881	11.020	-8.946	-47.651	5.029	48.744
23	-0.266	0.104	26.890	26.892	2.877	7.124	13.445	15.486
24	-3.909	-0.674	-4.527	6.019	21.546	1.462	21.929	30.777
25	-0.415	-6.420	-0.679	6.469	-4.007	-1.605	3.244	5.399
26	0.149	-0.710	5.975	6.019	-4.274	-0.748	4.607	6.328
27	4.269	-10.152	-3.917	11.689	-79.107	-30.645	-7.247	85.145
28	2.269	-1.265	0.375	2.625	-0.758	-0.693	-0.141	1.037
29	-0.104	-0.040	-2.576	2.578	0.135	-0.256	-15.323	15.325
30	2.399	0.551	0.703	2.560	-1.587	-0.472	0.970	1.919