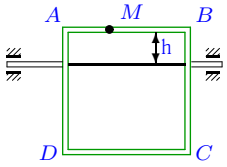
Сложное движение точки, пространственная траектория

Геометрическая фигура вращается вокруг оси, лежащей в ее плоскости. По каналу, расположенному на фигуре, движется точка M по известному закону $AM(t)$ или $BM(t)$ (в см). Найти абсолютную скорость и абсолютное ускорение точки при $t = t_1$. Даны закон вращения фигуры $\varphi_e(t)$ (или постоянная угловая скорость ω_e), время t_1 и размеры фигуры. Углы даны в рад, размеры — в см. Длина BM или AM — длина отрезка прямой или дуги окружности, AB — длина отрезка прямой.

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.:ФИЗМАТЛИТ, 2002.– 384 с. (с.202.)

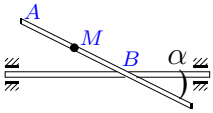
Задача 11.1. 7



$\varphi_e = 0.5t^2$,

$AM = \frac{2}{3}(t^2 + 52)$,
$AB = 30$,
$BC = 30$,
$h = 10$,
$t = 3$ с.

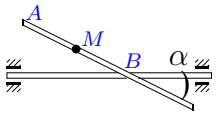
Задача 11.2. 7



$\varphi_e = 0.07t^2$,

$AM = \frac{5}{6}(t^2 + 4)t$,
$AB = 78$,
$\alpha = \pi/4$,
$t = 3$ с.

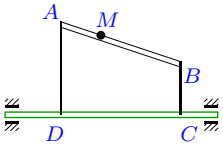
Задача 11.3. 7



$\varphi_e = 0.14t^2$,

$AM = \frac{3}{4}(t^2 + 4t)$,
$AB = 24$,
$\alpha = \pi/4$,
$t = 2$ с.

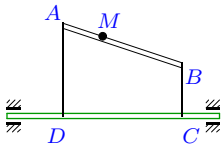
Задача 11.4. 7



$\varphi_e = 0.31t^2$,

$AM = \frac{3}{4}(t^3 + 4)$,
$AD = 19$,
$BC = 9$,
$DC = 27$,
$t = 3$ с.

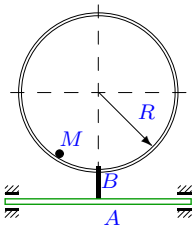
Задача 11.5. 7



$\varphi_e = 0.02t^2$,

$AM = \frac{1}{4}(t^2 + 6t)$,
$AD = 17$,
$BC = 8$,
$DC = 23$,
$t = 3$ с.

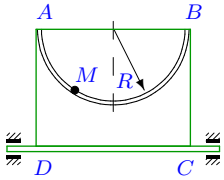
Задача 11.6. 7



$\omega_e = 0.55$ рад/с,

$BM = \frac{\pi}{3}(t^3 + 3)$,
$R = 11$,
$AB = 6$,
$t = 2$ с.

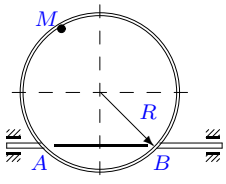
Задача 11.7. 7



$\omega_e = 0.25$ рад/с,

$AM = \frac{5\pi}{6}(t^2 + 52)$,
$R = 61$,
$AD = 62$,
$t = 3$ с.

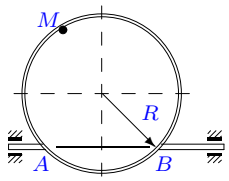
Задача 11.8. 7



$\omega_e = 0.05$ рад/с,

$AM = \frac{3\pi}{4}(t^2 + 51)$,
$R = 55$,
$AB = 55$,
$t = 2$ с.

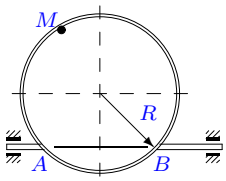
Задача 11.9. 7



$\omega_e = 0.29$ рад/с,

$AM = \dfrac{3\pi}{4}(t^2 + 6t)$,
$R = 27$,
$AB = 27$,
$t = 3$ с.

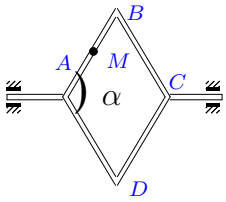
Задача 11.10. 7



$\omega_e = 0.06$ рад/с,

$AM = \dfrac{\pi}{4}(t^2 + 52)$,
$R = 61$,
$AB = 61$,
$t = 3$ с.

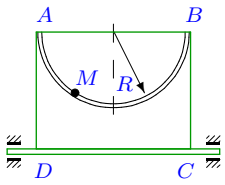
Задача 11.11. 7



$\varphi_e = 0.25t^2$,

$BM = \dfrac{2}{3}(t^2 + 3)t$,
Ромб $ABCD$.
$AB = 21$,
$\alpha = 2\pi/3$,
$t = 2$ с.

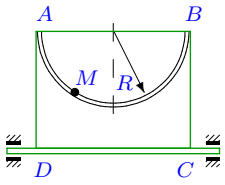
Задача 11.12. 7



$\omega_e = 0.69$ рад/с,

$AM = \dfrac{2\pi}{3}(t^2 + 52)$,
$R = 61$,
$AD = 62$,
$t = 3$ с.

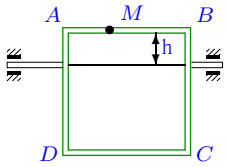
Задача 11.13. 7



$\omega_e = 0.5$ рад/с,

$AM = \dfrac{\pi}{3}(t^2 + 51)$,
$R = 55$,
$AD = 56$,
$t = 2$ с.

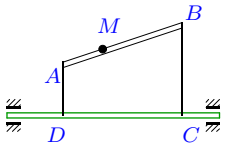
Задача 11.14. 7



$\varphi_e = 0.83t^2$,

$AM = \dfrac{5}{6}(t^2 + 4t)$,
$AB = 6$,
$BC = 6$,
$h = 2$,
$t = 2$ с.

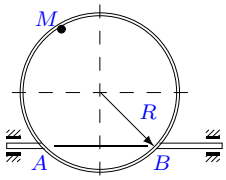
Задача 11.15. 7



$\varphi_e = 0.1t^2$,

$AM = \dfrac{1}{6}(t^2 + 3)t$,
$AD = 5$,
$BC = 11$,
$DC = 12$,
$t = 2$ с.

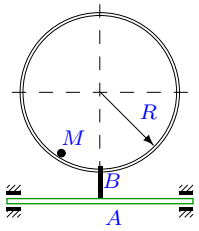
Задача 11.16. 7



$\omega_e = 0.54$ рад/с,

$AM = \dfrac{\pi}{3}(t^2 + 6t)$,
$R = 27$,
$AB = 27$,
$t = 3$ с.

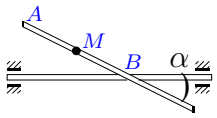
Задача 11.17. 7



$\omega_e = 0.1$ рад/с,

$BM = \dfrac{5\pi}{3}(t^2 + 50)$,
$R = 51$,
$AB = 26$,
$t = 1$ с.

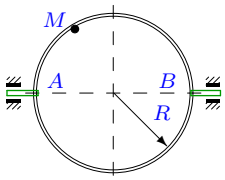
Задача 11.18. 7



$\varphi_e = 0.27t^2$,

$AM = \dfrac{5}{6}(t^2 + 3)t$,
$AB = 28$,
$\alpha = \pi/4$,
$t = 2$ с.

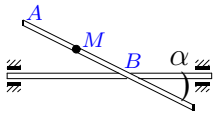
Задача 11.19. 7



$\omega_e = 1.32$ рад/с,

$AM = \dfrac{\pi}{3}(t^3 + 3)$,
$R = 11$,
$t = 2$ с.

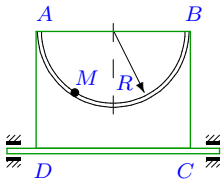
Задача 11.20. 7



$\varphi_e = 0.13t^2$,

$AM = \dfrac{1}{2}(t^2 + 3)t$,
$AB = 28$,
$\alpha = \pi/4$,
$t = 2$ с.

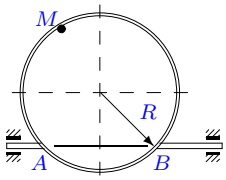
Задача 11.21. 7



$\omega_e = 4.71$ рад/с,

$AM = \dfrac{\pi}{2}(t^2 + 52)$,
$R = 61$,
$AD = 62$,
$t = 3$ с.

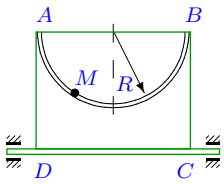
Задача 11.22. 7



$\omega_e = 1.71$ рад/с,

$AM = \dfrac{3\pi}{4}(t^2 + 2t)$,
$R = 3$,
$AB = 3$,
$t = 1$ с.

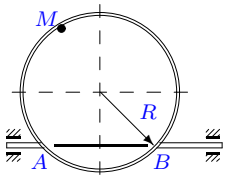
Задача 11.23. 7



$\omega_e = 3.96$ рад/с,

$AM = \dfrac{5\pi}{6}(t^2 + 4)t$,
$R = 39$,
$AD = 40$,
$t = 3$ с.

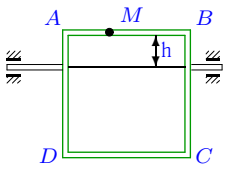
Задача 11.24. 7



$\omega_e = 2.86$ рад/с,

$AM = \dfrac{3\pi}{2}(t^2 + 6t)$,
$R = 27$,
$AB = 27$,
$t = 3$ с.

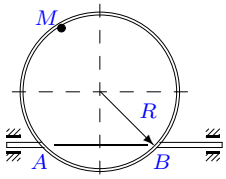
Задача 11.25. 7



$\varphi_e = 0.42t^2$,

$AM = \dfrac{1}{3}(t^2 + 2)t$,
$AB = 2$,
$BC = 2$,
$h = 1$,
$t = 1$ с.

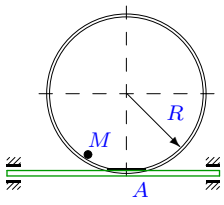
Задача 11.26. 7



$\omega_e = 0.05$ рад/с,

$AM = \dfrac{2\pi}{3}(t^2 + 50)$,
$R = 51$,
$AB = 51$,
$t = 1$ с.

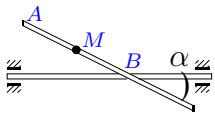
Задача 11.27. 7



$\omega_e = 0.76$ рад/с,

$AM = \dfrac{2\pi}{3}(t^3 + 3)$,
$R = 11$,
$t = 2$ с.

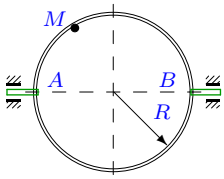
Задача 11.28. 7



$\varphi_e = 0.09t^2$,

$AM = \dfrac{1}{3}(t^2 + 2t)$,
$AB = 6$,
$\alpha = \pi/4$,
$t = 1$ с.

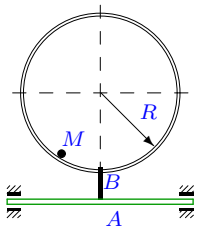
Задача 11.29. 7



$\omega_e = 5.71$ рад/с,

$AM = \dfrac{5\pi}{6}(t^3 + 3)$,
$R = 11$,
$t = 2$ с.

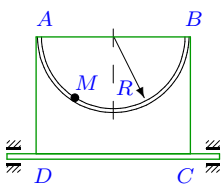
Задача 11.30. 7



$\omega_e = 0.6$ рад/с,

$BM = \dfrac{\pi}{3}(t^2 + 2t)$,
$R = 3$,
$AB = 2$,
$t = 1$ с.

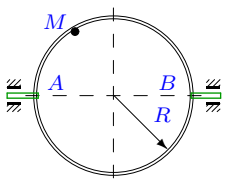
Задача 11.31. 7



$\omega_e = 2.09$ рад/с,

$AM = \dfrac{3\pi}{4}(t^2 + 4t)$,
$R = 12$,
$AD = 13$,
$t = 2$ с.

Задача 11.32. 7



$\omega_e = 0.12$ рад/с,

$AM = \dfrac{2\pi}{3}(t^2 + 52)$,
$R = 61$,
$t = 3$ с.

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	0.667	4.000	2.000	4.472	3.000	1.000
2	32.173	25.833	-13.513	29.154	0.420	0.140
3	10.607	6.000	5.940	8.443	0.560	0.280
4	10.925	20.250	20.320	28.688	1.860	0.620
5	14.540	3.000	-1.745	3.471	0.120	0.040
6	11.500	12.566	-6.325	14.068	0.550	0.000
7	31.500	15.708	-7.875	17.571	0.250	0.000
8	100.757	9.425	-5.038	10.687	0.050	0.000
9	49.463	28.274	-14.344	31.705	0.290	0.000
10	37.040	4.712	-2.222	5.210	0.060	0.000
11	10.104	10.000	10.104	14.216	1.000	0.500
12	9.172	12.566	-6.329	14.070	0.690	0.000
13	8.369	4.189	4.184	5.921	0.500	0.000
14	2.000	6.667	-6.640	9.409	3.320	1.660
15	6.043	2.500	2.417	3.478	0.400	0.200
16	23.383	12.566	12.627	17.814	0.540	0.000
17	51.500	10.472	-5.150	11.670	0.100	0.000
18	11.549	12.500	12.473	17.659	1.080	0.540
19	9.526	12.566	12.575	17.777	1.320	0.000
20	14.849	7.500	7.722	10.764	0.520	0.260
21	1.000	9.425	-4.710	10.536	4.710	0.000
22	5.496	9.425	9.398	13.310	1.710	0.000
23	20.500	81.158	81.180	114.790	3.960	0.000
24	9.883	56.549	-28.264	63.219	2.860	0.000
25	1.000	1.667	-0.840	1.866	0.840	0.840
26	88.335	4.189	4.417	6.087	0.050	0.000
27	16.500	25.133	-12.540	28.087	0.760	0.000
28	3.536	1.333	-0.636	1.477	0.180	0.180
29	5.500	31.416	31.405	44.421	5.710	0.000
30	3.500	4.189	-2.100	4.686	0.600	0.000
31	4.515	18.850	-9.436	21.079	2.090	0.000
32	52.828	12.566	-6.339	14.075	0.120	0.000

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	0.000	1.333	-6.000	0.667	24.000	4.667	24.667	25.104
2	0.000	15.000	5.675	-4.504	15.344	-16.282	10.840	22.251
3	0.000	1.500	3.326	2.970	4.752	-4.387	-1.782	4.852
4	0.000	13.500	37.796	6.773	26.163	-42.485	-19.390	48.386
5	0.000	0.500	0.209	-0.582	0.262	-0.392	-0.319	0.687
6	14.356	12.566	3.479	0.000	11.971	14.582	-11.971	19.843
7	4.045	5.236	1.969	0.000	6.802	4.588	-6.802	8.252
8	1.615	4.712	0.252	0.000	0.244	-0.592	-0.244	5.011
9	29.609	4.712	4.160	0.000	4.244	-31.540	-4.244	34.088
10	0.364	1.571	0.133	0.000	0.546	1.478	-0.546	1.577
11	0.000	8.000	10.104	5.052	17.321	-17.032	-12.269	21.368
12	2.589	4.189	4.367	0.000	8.671	-0.031	-8.671	8.979
13	0.319	2.094	2.092	0.000	2.094	-2.863	-2.094	4.059
14	0.000	1.667	-22.045	-3.320	44.267	20.378	-47.587	51.766
15	0.000	2.000	0.967	1.209	0.894	-0.073	2.103	2.762
16	5.849	2.094	6.818	0.000	13.572	-4.724	13.572	15.515
17	2.150	10.472	0.515	0.000	1.814	-8.509	1.814	11.228
18	0.000	10.000	13.471	6.237	19.092	-20.542	-12.855	25.244
19	14.356	12.566	16.599	0.000	16.588	-22.748	16.588	33.449
20	0.000	6.000	4.015	3.861	5.515	-8.258	-1.655	9.430
21	1.456	3.142	22.184	0.000	0.000	-20.728	0.000	20.965
22	29.609	4.712	16.070	0.000	8.342	-43.451	8.342	45.900
23	168.887	47.124	321.473	0.000	556.655	-196.219	556.655	602.845
24	118.435	9.425	80.836	0.000	280.123	-29.781	280.123	301.438
25	0.000	2.000	0.706	-0.840	0.000	-0.706	-0.840	2.281
26	0.344	4.189	0.221	0.000	0.209	1.576	0.209	4.119
27	57.423	25.133	9.530	0.000	33.084	-16.476	-33.084	72.435
28	0.000	0.667	0.115	-0.636	0.339	-0.586	-0.297	0.809
29	89.724	31.416	179.323	0.000	310.704	-251.391	-310.704	404.448
30	5.849	2.094	1.260	0.000	4.353	3.478	-4.353	6.870
31	29.609	4.712	19.721	0.000	55.714	4.548	-55.714	58.606
32	2.589	4.189	0.761	0.000	1.508	-5.097	1.508	5.805