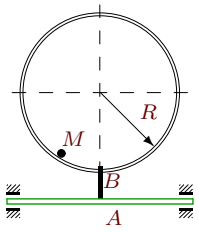
Сложное движение точки, пространственная траектория

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.)

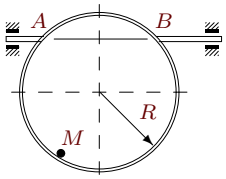
Задача 11.1 *3*



$\omega_e = 0.04$ рад/с,

$BM = \dfrac{\pi}{3}(t^2 + 51)$,
$R = 55$,
$AB = 28$,
$t = 2$ с.

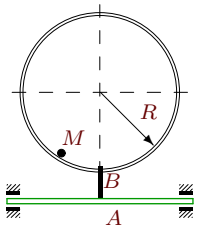
Задача 11.2 *3*



$\omega_e = 3.22$ рад/с,

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

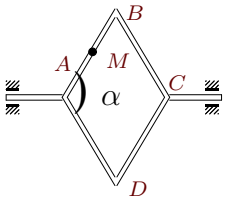
Задача 11.3 *3*



$\omega_e = 0.53$ рад/с,

$BM = \dfrac{\pi}{4}(t^2 + 3)t$,
$R = 14$,
$AB = 7$,
$t = 2$ с.

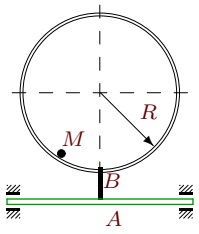
Задача 11.4 *3*



$\varphi_e = 0.02t^2$,

$BM = \dfrac{1}{6}(t^2 + 3)t$,
Ромб $ABCD$.
$AB = 21$,
$\alpha = 2\pi/3$,
$t = 2$ с.

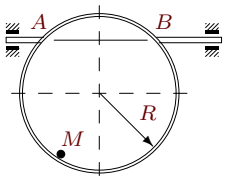
Задача 11.5 *3*



$\omega_e = 0.04$ рад/с,

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

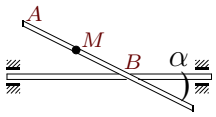
Задача 11.6 *3*



$\omega_e = 0.81$ рад/с,

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

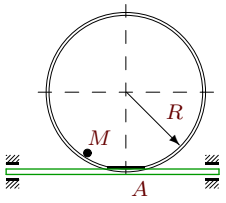
Задача 11.7 *3*



$\varphi_e = 0.01t^2$,

$AM = \dfrac{2}{3}(t^2 + 50)$,
$AB = 102$,
$\alpha = \pi/4$,
$t = 1$ с.

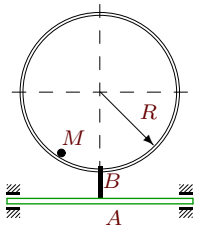
Задача 11.8 *3*



$\omega_e = 0.09$ рад/с,

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

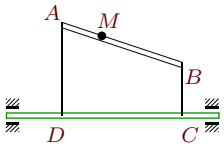
Задача 11.9 *3*



$\omega_e = 1.4$ рад/с,

$BM = \dfrac{4\pi}{3}(t^2 + 4t)$,
$R = 12$,
$AB = 6$,
$t = 2$ с.

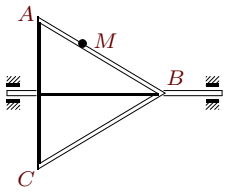
Задача 11.10 *3*



$\varphi_e = 0.11t^2$,

$AM = \dfrac{1}{2}(t^3 + 3)$,
$AD = 9$,
$BC = 4$,
$DC = 10$,
$t = 2$ с.

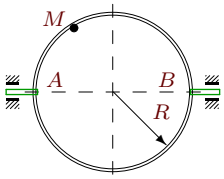
Задача 11.11 *3*



$\varphi_e = 0.01t^2$,

$AM = \dfrac{1}{2}(t^2 + 52)$,
AB=BC=AC=122,
$t = 3$ с.

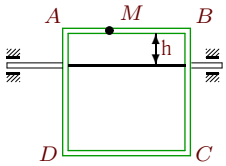
Задача 11.12 *3*



$\omega_e = 5.24$ рад/с,

$AM = \dfrac{5\pi}{6}(t^3 + 2)$,
$R = 3$,
$t = 1$ с.

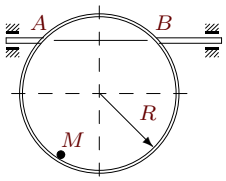
Задача 11.13 *3*



$\varphi_e = 3.44t^2$,

$AM = \dfrac{2}{3}(t^2 + 4)t$,
$AB = 20$,
$BC = 20$,
$h = 7$,
$t = 3$ с.

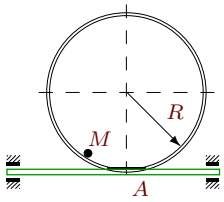
Задача 11.14 *3*



$\omega_e = 0.81$ рад/с,

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

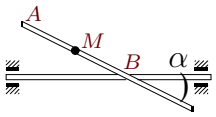
Задача 11.15 *3*



$\omega_e = 0.1$ рад/с,

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

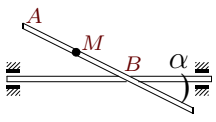
Задача 11.16 *3*



$\varphi_e = 0t^2$,

$AM = \dfrac{1}{6}(t^2 + 52)$,
$AB = 122$,
$\alpha = \pi/4$,
$t = 3$ с.

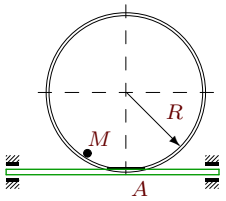
Задача 11.17 *3*



$\varphi_e = 0t^2$,

$AM = \dfrac{1}{4}(t^2 + 52)$,
$AB = 122$,
$\alpha = \pi/4$,
$t = 3$ с.

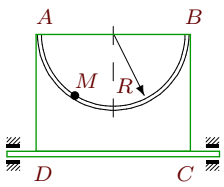
Задача 11.18 *3*



$\omega_e = 4.1$ рад/с,

$AM = \dfrac{3\pi}{2}(t^3 + 4)$,
$R = 31$,
$t = 3$ с.

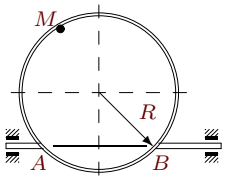
Задача 11.19 *3*



$\omega_e = 0.75$ рад/с,

$AM = \dfrac{3\pi}{4}(t^2 + 52)$,
$R = 61$,
$AD = 62$,
$t = 3$ с.

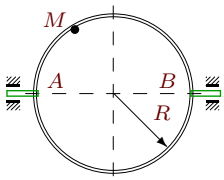
Задача 11.20 *3*



$\omega_e = 0.06$ рад/с,

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

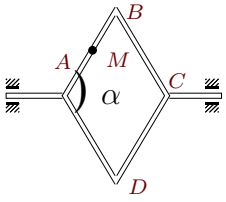
Задача 11.21 *3*



$\omega_e = 0.66$ рад/с,

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

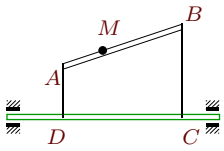
Задача 11.22 *3*



$\varphi_e = 0.64t^2$,

$BM = \dfrac{5}{6}(t^2 + 2t)$,
Ромб $ABCD$.
$AB = 4$,
$\alpha = 2\pi/3$,
$t = 1$ с.

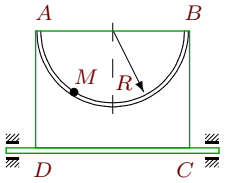
Задача 11.23 *3*



$\varphi_e = 0.18t^2$,

$AM = \dfrac{2}{3}(t^2 + 4)t$,
$AD = 11$,
$BC = 23$,
$DC = 34$,
$t = 3$ с.

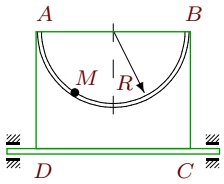
Задача 11.24 *3*



$\omega_e = 5.49$ рад/с,

$AM = \dfrac{\pi}{3}(t^3 + 4)$,
$R = 31$,
$AD = 32$,
$t = 3$ с.

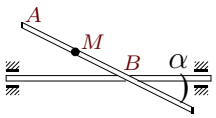
Задача 11.25 *3*



$\omega_e = 0.5$ рад/с,

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

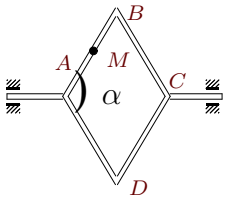
Задача 11.26 *3*



$\varphi_e = 0.42t^2$,

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

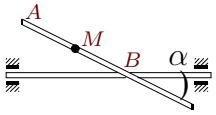
Задача 11.27 *3*



$\varphi_e = 0.77t^2$,

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

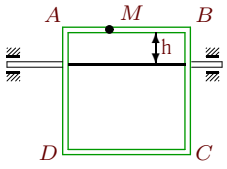
Задача 11.28 *3*



$\varphi_e = 0.03t^2$,

$AM = \dfrac{1}{2}(t^2 + 4)t$,
$AB = 78$,
$\alpha = \pi/4$,
$t = 3$ с.

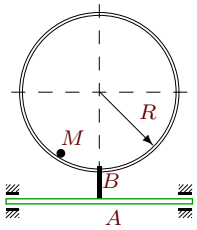
Задача 11.29 *3*



$\varphi_e = 1.07t^2$,

$AM = \dfrac{5}{6}(t^3 + 3)$,
$AB = 6$,
$BC = 6$,
$h = 2$,
$t = 2$ с.

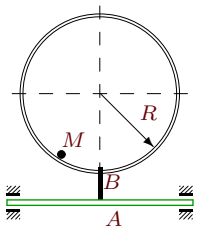
Задача 11.30 *3*



$\omega_e = 0.02$ рад/с,

$BM = \dfrac{\pi}{4}(t^2 + 50)$,
$R = 51$,
$AB = 26$,
$t = 1$ с.

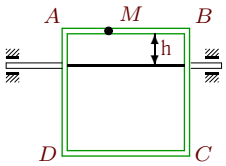
Задача 11.31 *3*



$\omega_e = 0.35$ рад/с,

$BM = \dfrac{\pi}{3}(t^2 + 4t)$,
$R = 12$,
$AB = 6$,
$t = 2$ с.

Задача 11.32 *3*



$\varphi_e = 0.17t^2$,

$AM = \dfrac{1}{6}(t^2 + 4t)$,
$AB = 6$,
$BC = 6$,
$h = 2$,
$t = 2$ с.

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	55.500	4.189	-2.220	4.741	0.040	0.000
2	2.598	16.755	8.366	18.728	3.220	0.000
3	11.101	11.781	-5.883	13.168	0.530	0.000
4	16.166	2.500	-1.293	2.815	0.080	0.040
5	51.500	2.094	2.060	2.938	0.040	0.000
6	5.196	8.378	4.209	9.375	0.810	0.000
7	48.083	1.333	-0.962	1.644	0.020	0.020
8	51.000	9.425	-4.590	10.483	0.090	0.000
9	24.000	33.510	33.600	47.454	1.400	0.000
10	6.540	6.000	-2.878	6.654	0.440	0.220
11	45.750	3.000	2.745	4.066	0.060	0.020
12	1.500	7.854	7.860	11.111	5.240	0.000
13	1.000	20.667	20.640	29.208	20.640	6.880
14	10.392	8.378	-8.418	11.876	0.810	0.000
15	16.109	3.142	-1.611	3.531	0.100	0.000
16	79.078	1.000	0.000	1.000	0.000	0.000
17	75.484	1.500	0.000	1.500	0.000	0.000
18	31.000	127.235	127.100	179.842	4.100	0.000
19	18.866	14.137	14.150	20.002	0.750	0.000
20	111.749	14.137	-6.705	15.647	0.060	0.000
21	9.526	12.566	-6.287	14.051	0.660	0.000
22	1.299	3.333	-1.663	3.725	1.280	1.280
23	19.653	20.667	21.226	29.625	1.080	0.360
24	5.153	28.274	28.291	39.998	5.490	0.000
25	8.369	4.189	4.184	5.921	0.500	0.000
26	2.652	2.250	2.227	3.166	0.840	0.840
27	1.732	2.667	2.667	3.772	1.540	1.540
28	41.366	15.500	-7.446	17.196	0.180	0.060
29	1.167	10.000	4.993	11.177	4.280	2.140
30	40.938	1.571	-0.819	1.771	0.020	0.000
31	12.000	8.378	-4.200	9.371	0.350	0.000
32	2.000	1.333	1.360	1.905	0.680	0.340

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	0.319	2.094	0.089	0.000	0.290	1.885	-0.290	2.057
2	93.578	8.378	-26.938	0.000	107.903	35.315	-107.903	147.130
3	9.914	9.425	3.118	0.000	8.830	10.556	-8.830	13.767
4	0.000	2.000	0.103	-0.647	0.346	-1.836	-0.300	2.112
5	0.086	2.094	0.082	0.000	0.145	1.774	0.145	2.029
6	23.395	4.189	-3.409	0.000	6.786	21.575	6.786	27.320
7	0.000	1.333	0.019	-0.962	0.038	-0.962	-0.924	1.633
8	1.742	9.425	0.413	0.000	1.696	-9.838	1.696	10.134
9	93.578	8.378	47.040	0.000	81.258	-101.084	-81.258	150.756
10	0.000	6.000	1.266	-1.439	2.361	-3.949	0.922	6.727
11	0.000	1.000	0.165	0.915	0.180	-0.665	0.735	1.316
12	20.562	15.708	41.186	0.000	71.282	-65.071	-71.282	97.028
13	0.000	12.000	426.010	6.880	853.120	-438.010	-846.240	952.877
14	5.849	2.094	-6.818	0.000	13.572	4.724	-13.572	15.515
15	0.179	1.571	0.161	0.000	0.444	1.077	-0.444	1.525
16	0.000	0.333	0.000	0.000	0.000	-0.236	0.000	0.333
17	0.000	0.500	0.000	0.000	0.000	-0.354	0.000	0.500
18	522.214	84.823	521.110	0.000	1043.323	-605.933	-1043.323	1314.680
19	3.276	4.712	10.612	0.000	14.995	-4.963	14.995	15.827
20	3.276	4.712	0.402	0.000	0.439	-2.347	-0.439	5.904
21	14.356	12.566	4.150	0.000	8.294	-10.299	-8.294	22.384
22	0.000	1.667	2.128	-1.663	7.390	-3.572	5.727	6.801
23	0.000	12.000	22.924	7.075	14.857	-18.930	21.932	31.103
24	25.788	18.850	155.318	0.000	155.226	-142.410	-155.226	212.672
25	0.319	2.094	2.092	0.000	2.094	-2.863	-2.094	4.059
26	0.000	4.500	1.871	2.227	2.673	-5.053	-0.445	5.988
27	0.000	1.333	4.108	2.667	7.113	-5.262	-4.446	6.921
28	0.000	9.000	1.340	-2.482	3.946	-7.704	1.464	10.099
29	0.000	10.000	-21.371	2.497	85.600	11.371	88.097	88.828
30	0.048	1.571	0.016	0.000	0.044	1.129	-0.044	1.560
31	5.849	2.094	1.470	0.000	5.079	3.268	-5.079	7.254
32	0.000	0.333	0.925	0.680	0.000	-0.925	0.680	1.195