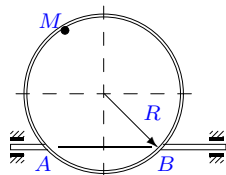


Сложное движение точки, пространственная траектория

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.

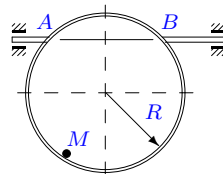
Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.— М.:ФИЗМАТЛИТ, 2002.— 384 с. (с.202.)

Задача 11.1.



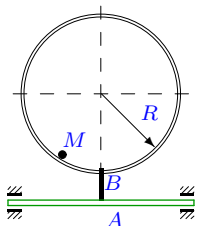
$$\begin{aligned} \omega_e &= 0.05 \text{ рад/с,} \\ AM &= \frac{2\pi}{3}(t^2 + 50), \\ R &= 51, \\ AB &= 51, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.2.



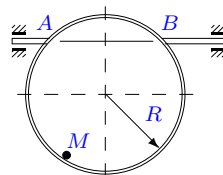
$$\begin{aligned} \omega_e &= 5 \text{ рад/с,} \\ AM &= \frac{5\pi}{3}(t^2 + 2)t, \\ R &= 3, \\ AB &= 3, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.3.



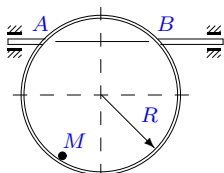
$$\begin{aligned} \omega_e &= 0.04 \text{ рад/с,} \\ BM &= \frac{\pi}{3}(t^2 + 51), \\ R &= 55, \\ AB &= 28, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.4.



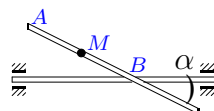
$$\begin{aligned} \omega_e &= 1.29 \text{ рад/с,} \\ AM &= \frac{\pi}{4}(t^3 + 2), \\ R &= 3, \\ AB &= 3, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.5.



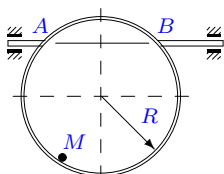
$$\begin{aligned} \omega_e &= 1.92 \text{ рад/с,} \\ AM &= \frac{4\pi}{3}(t^2 + 4)t, \\ R &= 39, \\ AB &= 39, \\ t &= 3 \text{ с.} \end{aligned}$$

Задача 11.6.



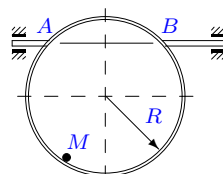
$$\begin{aligned} \varphi_e &= 0.23t^2, \\ AM &= \frac{3}{4}(t^3 + 3), \\ AB &= 22, \\ \alpha &= \pi/4, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.7.



$$\begin{aligned} \omega_e &= 0.06 \text{ рад/с,} \\ AM &= \frac{3\pi}{4}(t^2 + 52), \\ R &= 61, \\ AB &= 61, \\ t &= 3 \text{ с.} \end{aligned}$$

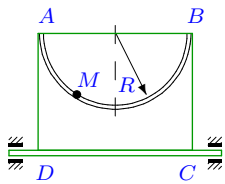
Задача 11.8.



$$\begin{aligned} \omega_e &= 1.41 \text{ рад/с,} \\ AM &= \frac{\pi}{4}(t^3 + 3), \\ R &= 11, \\ AB &= 11, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.9.

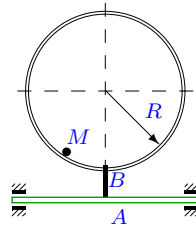
4



$\omega_e = 0.6 \text{ рад/с,}$
 $AM = \frac{\pi}{6}(t^2 + 4t),$
 $R = 12,$
 $AD = 13,$
 $t = 2 \text{ с.}$

Задача 11.10.

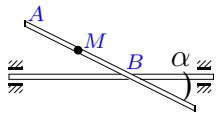
4



$\omega_e = 0.2 \text{ рад/с,}$
 $BM = \frac{5\pi}{3}(t^2 + 50),$
 $R = 51,$
 $AB = 26,$
 $t = 1 \text{ с.}$

Задача 11.11.

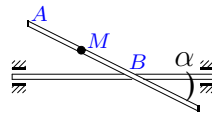
4



$\varphi_e = 0.01t^2,$
 $AM = \frac{1}{4}(t^2 + 4)t,$
 $AB = 78,$
 $\alpha = \pi/4,$
 $t = 3 \text{ с.}$

Задача 11.12.

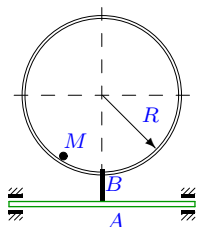
4



$\varphi_e = 0.03t^2,$
 $AM = \frac{1}{6}(t^2 + 3)t,$
 $AB = 28,$
 $\alpha = \pi/4,$
 $t = 2 \text{ с.}$

Задача 11.13.

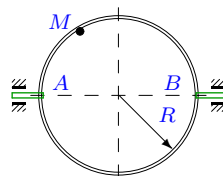
4



$\omega_e = 0.12 \text{ рад/с,}$
 $BM = \frac{3\pi}{2}(t^2 + 50),$
 $R = 51,$
 $AB = 26,$
 $t = 1 \text{ с.}$

Задача 11.14.

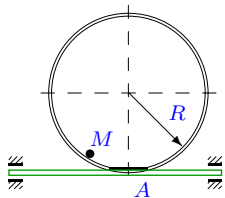
4



$\omega_e = 0.54 \text{ рад/с,}$
 $AM = \frac{\pi}{3}(t^2 + 6t),$
 $R = 27,$
 $t = 3 \text{ с.}$

Задача 11.15.

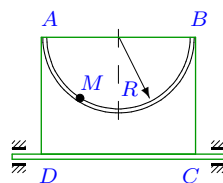
4



$\omega_e = 1.4 \text{ рад/с,}$
 $AM = \frac{2\pi}{3}(t^3 + 2),$
 $R = 3,$
 $t = 1 \text{ с.}$

Задача 11.16.

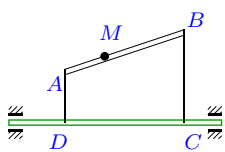
4



$\omega_e = 3.14 \text{ рад/с,}$
 $AM = \frac{\pi}{2}(t^2 + 51),$
 $R = 55,$
 $AD = 56,$
 $t = 2 \text{ с.}$

Задача 11.17.

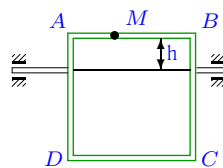
4



$\varphi_e = 0.01t^2,$
 $AM = \frac{1}{4}(t^2 + 50),$
 $AD = 14,$
 $BC = 29,$
 $DC = 44,$
 $t = 1 \text{ с.}$

Задача 11.18.

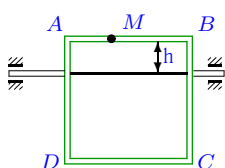
4



$\varphi_e = 0.01t^2,$
 $AM = \frac{1}{6}(t^2 + 50),$
 $AB = 26,$
 $BC = 26,$
 $h = 9,$
 $t = 1 \text{ с.}$

Задача 11.19.

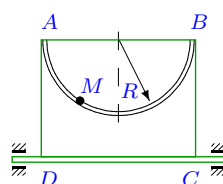
4



$\varphi_e = 1.17t^2,$
 $AM = \frac{5}{6}(t^2 + 3)t,$
 $AB = 7,$
 $BC = 7,$
 $h = 2,$
 $t = 2 \text{ с.}$

Задача 11.20.

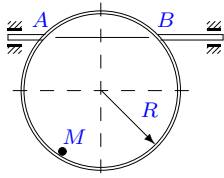
4



$\omega_e = 2.09 \text{ рад/с,}$
 $AM = \frac{5\pi}{6}(t^2 + 2t),$
 $R = 3,$
 $AD = 4,$
 $t = 1 \text{ с.}$

Задача 11.21.

4



$$\omega_e = 0.48 \text{ рад/с,}$$

$$AM = \frac{4\pi}{3}(t^2 + 52),$$

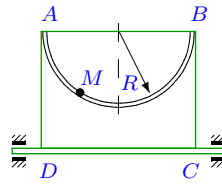
$$R = 61,$$

$$AB = 61,$$

$$t = 3 \text{ с.}$$

Задача 11.22.

4



$$\omega_e = 0.25 \text{ рад/с,}$$

$$AM = \frac{\pi}{3}(t^2 + 51),$$

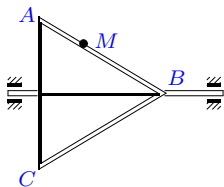
$$R = 55,$$

$$AD = 56,$$

$$t = 2 \text{ с.}$$

Задача 11.23.

4



$$\varphi_e = 0.02t^2,$$

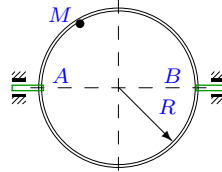
$$AM = \frac{1}{2}(t^2 + 6t),$$

$$AB = BC = AC = 54,$$

$$t = 3 \text{ с.}$$

Задача 11.24.

4



$$\omega_e = 5.55 \text{ рад/с,}$$

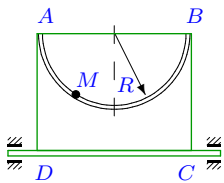
$$AM = \frac{3\pi}{4}(t^2 + 2)t,$$

$$R = 3,$$

$$t = 1 \text{ с.}$$

Задача 11.25.

4



$$\omega_e = 2.94 \text{ рад/с,}$$

$$AM = \frac{3\pi}{4}(t^2 + 4)t,$$

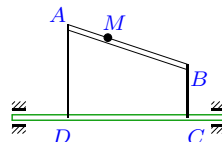
$$R = 39,$$

$$AD = 40,$$

$$t = 3 \text{ с.}$$

Задача 11.26.

4



$$\varphi_e = 0.17t^2,$$

$$AM = \frac{1}{2}(t^3 + 4),$$

$$AD = 19,$$

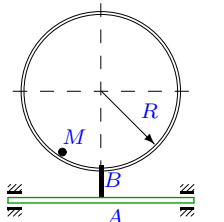
$$BC = 9,$$

$$DC = 27,$$

$$t = 3 \text{ с.}$$

Задача 11.27.

4



$$\omega_e = 0.1 \text{ рад/с,}$$

$$BM = \frac{\pi}{4}(t^2 + 52),$$

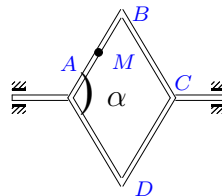
$$R = 61,$$

$$AB = 30,$$

$$t = 3 \text{ с.}$$

Задача 11.28.

4



$$\varphi_e = 0.17t^2,$$

$$BM = \frac{3}{4}(t^3 + 3),$$

Ромб ABCD.

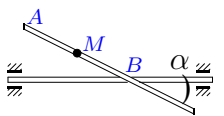
$$AB = 16,$$

$$\alpha = 2\pi/3,$$

$$t = 2 \text{ с.}$$

Задача 11.29.

4



$$\varphi_e = 0.01t^2,$$

$$AM = \frac{2}{3}(t^2 + 51),$$

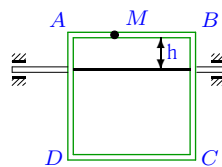
$$AB = 110,$$

$$\alpha = \pi/4,$$

$$t = 2 \text{ с.}$$

Задача 11.30.

4



$$\varphi_e = 0.42t^2,$$

$$AM = \frac{1}{6}(t^2 + 2)t,$$

$$AB = 2,$$

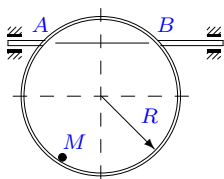
$$BC = 2,$$

$$h = 1,$$

$$t = 1 \text{ с.}$$

Задача 11.31.

4



$$\omega_e = 4.03 \text{ рад/с,}$$

$$AM = \frac{4\pi}{3}(t^2 + 2)t,$$

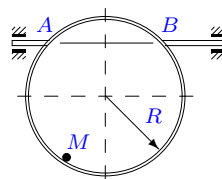
$$R = 3,$$

$$AB = 3,$$

$$t = 1 \text{ с.}$$

Задача 11.32.

4



$$\omega_e = 0.25 \text{ рад/с,}$$

$$AM = \frac{3\pi}{2}(t^2 + 50),$$

$$R = 51,$$

$$AB = 51,$$

$$t = 1 \text{ с.}$$

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	88.335	4.189	4.417	6.087	0.050	0.000
2	0.000	26.180	-0.000	26.180	5.000	0.000
3	55.500	4.189	-2.220	4.741	0.040	0.000
4	1.822	2.356	-2.350	3.328	1.290	0.000
5	33.775	129.852	64.848	145.145	1.920	0.000
6	9.723	9.000	8.945	12.689	0.920	0.460
7	111.749	14.137	6.705	15.647	0.060	0.000
8	6.679	9.425	-9.418	13.324	1.410	0.000
9	7.000	4.189	4.200	5.932	0.600	0.000
10	51.500	10.472	10.300	14.689	0.200	0.000
11	48.260	7.750	-2.896	8.273	0.060	0.020
12	18.149	2.500	2.178	3.316	0.120	0.060
13	77.000	9.425	9.240	13.199	0.120	0.000
14	23.383	12.566	12.627	17.814	0.540	0.000
15	4.500	6.283	6.300	8.898	1.400	0.000
16	1.000	6.283	-3.140	7.024	3.140	0.000
17	18.114	0.500	-0.362	0.617	0.020	0.020
18	9.000	0.333	-0.180	0.379	0.020	0.020
19	2.667	12.500	-12.480	17.664	4.680	2.340
20	2.500	10.472	-5.225	11.703	2.090	0.000
21	52.828	25.133	-25.357	35.702	0.480	0.000
22	8.369	4.189	-2.092	4.682	0.250	0.000
23	20.250	6.000	-2.430	6.473	0.120	0.040
24	2.121	11.781	11.773	16.655	5.550	0.000
25	12.423	73.042	-36.523	81.664	2.940	0.000
26	13.617	13.500	13.889	19.369	1.020	0.340
27	47.866	4.712	4.787	6.717	0.100	0.000
28	6.712	9.000	-4.564	10.091	0.680	0.340
29	51.854	2.667	-2.074	3.378	0.040	0.020
30	1.000	0.833	0.840	1.183	0.840	0.840
31	2.598	20.944	10.470	23.415	4.030	0.000
32	18.667	9.425	4.667	10.517	0.250	0.000

№	a_r^n	a_r^T	a_e^n	a_e^T	a_c	a_x	a_y	a
1	0.344	4.189	0.221	0.000	0.209	1.576	0.209	4.119
2	228.463	31.416	-0.000	0.000	130.900	-182.147	130.900	265.174
3	0.319	2.094	0.089	0.000	0.290	1.885	-0.290	2.057
4	1.851	4.712	-3.031	0.000	5.872	-1.999	-5.872	6.229
5	432.351	75.398	-124.508	0.000	498.634	199.906	-498.634	689.583
6	0.000	9.000	8.229	4.472	11.710	-14.593	-7.237	17.488
7	3.276	4.712	-0.402	0.000	0.439	2.347	0.439	5.904
8	8.075	9.425	-13.279	0.000	25.672	2.085	-25.672	26.309
9	1.462	1.047	2.520	0.000	4.353	-2.696	-4.353	5.424
10	2.150	10.472	2.060	0.000	3.628	-10.054	-3.628	12.831
11	0.000	4.500	0.174	-0.965	0.658	-3.356	-0.308	4.635
12	0.000	2.000	0.261	1.089	0.424	-1.676	0.665	2.291
13	1.742	9.425	1.109	0.000	2.262	-10.534	-2.262	10.914
14	5.849	2.094	6.818	0.000	6.786	-10.836	6.786	13.635
15	13.159	12.566	8.820	0.000	15.236	-4.517	15.236	23.772
16	0.718	3.142	9.860	0.000	0.000	-9.142	0.000	9.667
17	0.000	0.500	0.007	-0.362	0.006	0.154	-0.369	0.619
18	0.000	0.333	0.004	-0.180	0.000	-0.004	-0.180	0.379
19	0.000	10.000	-58.406	-6.240	117.000	48.406	-123.240	132.406
20	36.554	5.236	10.920	0.000	37.908	11.891	-37.908	49.211
21	10.355	8.378	-12.171	0.000	24.127	20.549	24.127	33.341
22	0.319	2.094	0.523	0.000	1.047	-1.294	1.047	2.582
23	0.000	1.000	0.292	-0.810	0.720	-0.792	-0.090	1.177
24	46.264	14.137	65.342	0.000	92.468	-108.052	-92.468	144.019
25	136.798	42.412	107.378	0.000	303.693	19.343	-303.693	311.542
26	0.000	9.000	14.167	4.630	9.565	-17.293	-4.935	19.865
27	0.364	1.571	0.479	0.000	0.666	0.889	0.666	1.401
28	0.000	9.000	3.103	-2.282	10.600	-10.898	8.318	14.429
29	0.000	1.333	0.083	-1.037	0.151	-1.026	-0.886	1.651
30	0.000	1.000	0.706	0.840	0.000	-0.706	0.840	1.484
31	146.216	25.133	-42.195	0.000	168.808	67.328	-168.808	233.256
32	1.742	9.425	-1.167	0.000	4.081	8.458	-4.081	11.265