

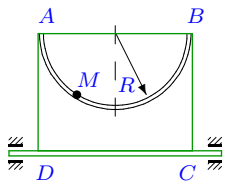
Сложное движение точки, пространственная траектория

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

Задача 11.1.

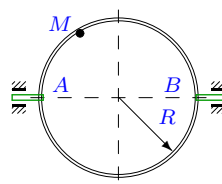
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$$\begin{aligned}\omega_e &= 0.18 \text{ рад/с}, \\ AM &= \frac{\pi}{4}(t^2 + 51), \\ R &= 55, \\ AD &= 56, \\ t &= 2 \text{ с}.\end{aligned}$$

Задача 11.2.

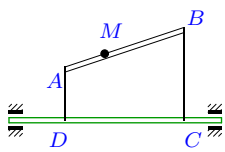
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$$\begin{aligned}\omega_e &= 0.05 \text{ рад/с}, \\ AM &= \frac{\pi}{4}(t^2 + 52), \\ R &= 61, \\ t &= 3 \text{ с}.\end{aligned}$$

Задача 11.3.

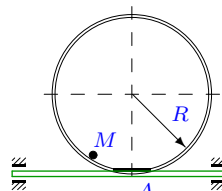
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$$\begin{aligned}\varphi_e &= 0.12t^2, \\ AM &= \frac{1}{2}(t^3 + 2), \\ AD &= 2, \\ BC &= 5, \\ DC &= 3, \\ t &= 1 \text{ с}.\end{aligned}$$

Задача 11.4.

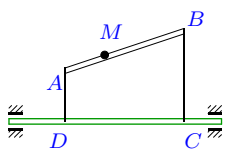
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$$\begin{aligned}\omega_e &= 1.15 \text{ рад/с}, \\ AM &= \frac{3\pi}{4}(t^2 + 2)t, \\ R &= 3, \\ t &= 1 \text{ с}.\end{aligned}$$

Задача 11.5.

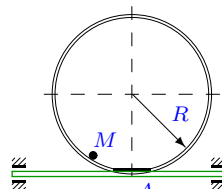
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$$\begin{aligned}\varphi_e &= 0.03t^2, \\ AM &= \frac{1}{6}(t^2 + 4t), \\ AD &= 4, \\ BC &= 9, \\ DC &= 10, \\ t &= 2 \text{ с}.\end{aligned}$$

Задача 11.6.

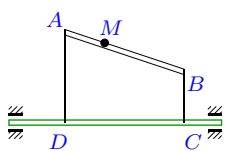
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$$\begin{aligned}\omega_e &= 11.42 \text{ рад/с}, \\ AM &= \frac{5\pi}{3}(t^3 + 3), \\ R &= 11, \\ t &= 2 \text{ с}.\end{aligned}$$

Задача 11.7.

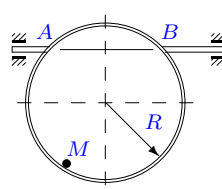
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$$\begin{aligned}\varphi_e &= 0.12t^2, \\ AM &= \frac{2}{3}(t^2 + 4)t, \\ AD &= 23, \\ BC &= 11, \\ DC &= 34, \\ t &= 3 \text{ с}.\end{aligned}$$

Задача 11.8.

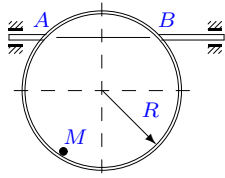
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$$\begin{aligned}\omega_e &= 1.32 \text{ рад/с}, \\ AM &= \frac{2\pi}{3}(t^3 + 3), \\ R &= 11, \\ AB &= 11, \\ t &= 2 \text{ с}.\end{aligned}$$

Задача 11.9.

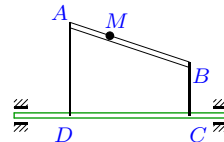
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$$\begin{aligned} \omega_e &= 21.46 \text{ рад/с,} \\ AM &= \frac{3\pi}{2}(t^2 + 2)t, \\ R &= 3, \\ AB &= 3, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.10.

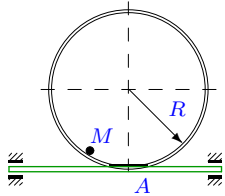
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$$\begin{aligned} \varphi_e &= 0.04t^2, \\ AM &= \frac{2}{3}(t^2 + 50), \\ AD &= 29, \\ BC &= 14, \\ DC &= 44, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.11.

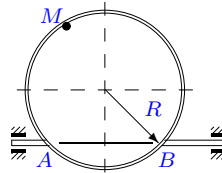
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$$\begin{aligned} \omega_e &= 2.23 \text{ рад/с,} \\ AM &= \frac{\pi}{4}(t^2 + 2)t, \\ R &= 3, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.12.

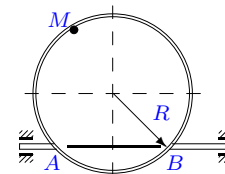
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$$\begin{aligned} \omega_e &= 14.04 \text{ рад/с,} \\ AM &= \frac{3\pi}{2}(t^3 + 3), \\ R &= 11, \\ AB &= 11, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.13.

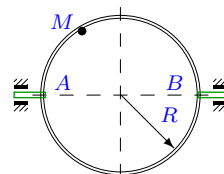
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$$\begin{aligned} \omega_e &= 5.12 \text{ рад/с,} \\ AM &= \frac{3\pi}{2}(t^2 + 4)t, \\ R &= 39, \\ AB &= 39, \\ t &= 3 \text{ с.} \end{aligned}$$

Задача 11.14.

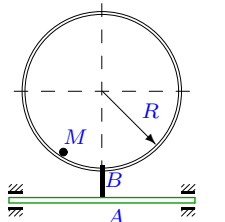
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$$\begin{aligned} \omega_e &= 0.93 \text{ рад/с,} \\ AM &= \frac{\pi}{4}(t^2 + 2)t, \\ R &= 3, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.15.

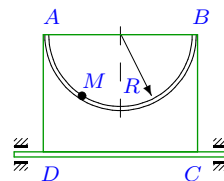
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$$\begin{aligned} \omega_e &= 0.82 \text{ рад/с,} \\ BM &= \frac{\pi}{4}(t^3 + 2), \\ R &= 3, \\ AB &= 2, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.16.

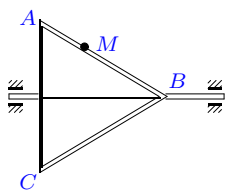
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$$\begin{aligned} \omega_e &= 0.09 \text{ рад/с,} \\ AM &= \frac{\pi}{4}(t^2 + 51), \\ R &= 55, \\ AD &= 56, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.17.

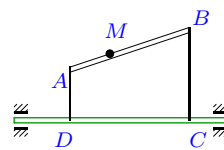
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$$\begin{aligned} \varphi_e &= 0.02t^2, \\ AM &= \frac{3}{4}(t^2 + 51), \\ AB=BC=AC &= 110, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.18.

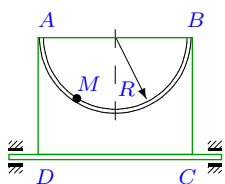
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$$\begin{aligned} \varphi_e &= 0.02t^2, \\ AM &= \frac{1}{3}(t^2 + 52), \\ AD &= 16, \\ BC &= 33, \\ DC &= 53, \\ t &= 3 \text{ с.} \end{aligned}$$

Задача 11.19.

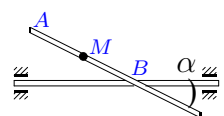
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$$\begin{aligned} \omega_e &= 18.85 \text{ рад/с,} \\ AM &= \frac{\pi}{2}(t^3 + 3), \\ R &= 11, \\ AD &= 12, \\ t &= 2 \text{ с.} \end{aligned}$$

Задача 11.20.

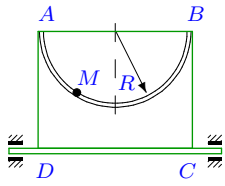
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$$\begin{aligned} \varphi_e &= 0.51t^2, \\ AM &= \frac{5}{6}(t^3 + 2), \\ AB &= 6, \\ \alpha &= \pi/4, \\ t &= 1 \text{ с.} \end{aligned}$$

Задача 11.21.

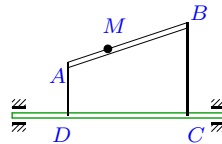
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$\omega_e = 3.14 \text{ рад/с,}$
 $AM = \frac{5\pi}{6}(t^3 + 2),$
 $R = 3,$
 $AD = 4,$
 $t = 1 \text{ с.}$

Задача 11.22.

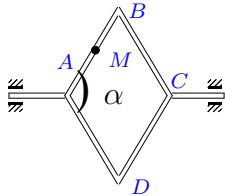
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$\varphi_e = 0.1t^2,$
 $AM = \frac{5}{6}(t^2 + 4)t,$
 $AD = 11,$
 $BC = 23,$
 $DC = 34,$
 $t = 3 \text{ с.}$

Задача 11.23.

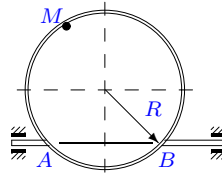
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$\varphi_e = 0.01t^2,$
 $BM = \frac{1}{6}(t^3 + 4),$
 Ромб $ABCD.$
 $AB = 46,$
 $\alpha = 2\pi/3,$
 $t = 3 \text{ с.}$

Задача 11.24.

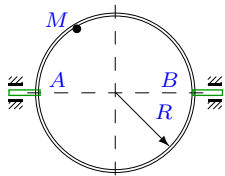
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$\omega_e = 0.06 \text{ рад/с,}$
 $AM = \frac{\pi}{4}(t^2 + 52),$
 $R = 61,$
 $AB = 61,$
 $t = 3 \text{ с.}$

Задача 11.25.

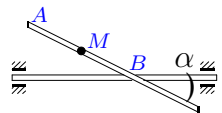
8



$\omega_e = 0.06 \text{ рад/с,}$
 $AM = \frac{\pi}{2}(t^2 + 51),$
 $R = 55,$
 $t = 2 \text{ с.}$

Задача 11.26.

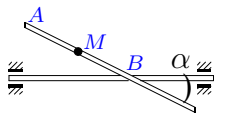
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$\varphi_e = 0.02t^2,$
 $AM = \frac{1}{6}(t^2 + 3)t,$
 $AB = 28,$
 $\alpha = \pi/4,$
 $t = 2 \text{ с.}$

Задача 11.27.

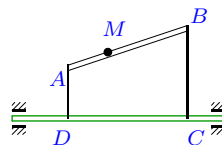
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$\varphi_e = 0.01t^2,$
 $AM = \frac{2}{3}(t^2 + 52),$
 $AB = 122,$
 $\alpha = \pi/4,$
 $t = 3 \text{ с.}$

Задача 11.28.

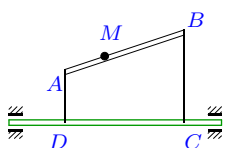
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$\varphi_e = 0.25t^2,$
 $AM = \frac{1}{2}(t^3 + 2),$
 $AD = 2,$
 $BC = 5,$
 $DC = 3,$
 $t = 1 \text{ с.}$

Задача 11.29.

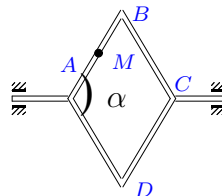
8



$\varphi_e = 0.52t^2,$
 $AM = \frac{3}{4}(t^2 + 2)t,$
 $AD = 2,$
 $BC = 5,$
 $DC = 3,$
 $t = 1 \text{ с.}$

Задача 11.30.

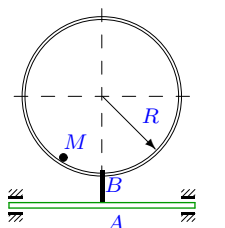
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$\varphi_e = 1.24t^2,$
 $BM = \frac{3}{4}(t^2 + 2)t,$
 Ромб $ABCD.$
 $AB = 4,$
 $\alpha = 2\pi/3,$
 $t = 1 \text{ с.}$

Задача 11.31.

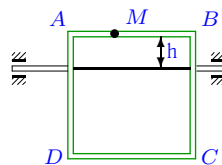
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$\omega_e = 2.24 \text{ рад/с,}$
 $BM = \frac{4\pi}{3}(t^2 + 3)t,$
 $R = 14,$
 $AB = 7,$
 $t = 2 \text{ с.}$

Задача 11.32.

8



$\varphi_e = 0.5t^2,$
 $AM = \frac{1}{2}(t^2 + 2t),$
 $AB = 2,$
 $BC = 2,$
 $h = 1,$
 $t = 1 \text{ с.}$

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	17.109	3.142	3.080	4.399	0.180	0.000
2	43.134	4.712	-2.157	5.182	0.050	0.000
3	3.061	1.500	-0.735	1.670	0.240	0.240
4	5.121	11.781	-5.890	13.171	1.150	0.000
5	4.894	1.333	-0.587	1.457	0.120	0.060
6	5.500	62.832	62.810	88.842	11.420	0.000
7	14.347	20.667	-10.330	23.104	0.720	0.240
8	19.053	25.133	-25.149	35.555	1.320	0.000
9	1.098	23.562	-23.565	33.324	21.460	0.000
10	18.029	1.333	1.442	1.964	0.080	0.080
11	0.879	3.927	-1.959	4.389	2.230	0.000
12	4.026	56.549	56.529	79.958	14.040	0.000
13	14.275	146.084	-73.088	163.347	5.120	0.000
14	2.121	3.927	-1.973	4.395	0.930	0.000
15	2.879	2.356	2.361	3.335	0.820	0.000
16	17.109	3.142	-1.540	3.499	0.090	0.000
17	34.375	3.000	2.750	4.070	0.080	0.040
18	22.210	2.000	2.665	3.332	0.120	0.040
19	1.000	18.850	18.850	26.658	18.850	0.000
20	2.475	2.500	2.524	3.553	1.020	1.020
21	2.500	7.854	7.850	11.104	3.140	0.000
22	21.817	25.833	-13.090	28.960	0.600	0.200
23	35.363	4.500	-2.122	4.975	0.060	0.020
24	37.040	4.712	-2.222	5.210	0.060	0.000
25	55.000	6.283	-3.300	7.097	0.060	0.000
26	18.149	2.500	-1.452	2.891	0.080	0.040
27	57.511	4.000	3.451	5.283	0.060	0.020
28	3.061	1.500	1.530	2.143	0.500	0.500
29	3.591	3.750	3.735	5.292	1.040	1.040
30	1.516	3.750	3.759	5.309	2.480	2.480
31	28.000	62.832	62.720	88.779	2.240	0.000
32	1.000	2.000	-1.000	2.236	1.000	1.000

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	0.179	1.571	0.554	0.000	0.800	-1.538	-0.800	2.130
2	0.364	1.571	0.108	0.000	0.333	0.745	-0.333	1.593
3	0.000	3.000	0.176	-0.735	0.509	1.945	-1.244	3.135
4	46.264	14.137	6.773	0.000	19.160	-29.490	-19.160	55.325
5	0.000	0.333	0.070	-0.294	0.143	0.079	-0.437	0.535
6	358.895	62.832	717.290	0.000	1242.815	-592.257	-1242.815	1418.618
7	0.000	12.000	7.437	-3.443	9.905	-11.431	6.462	17.334
8	57.423	25.133	-33.197	0.000	33.175	70.361	-33.175	92.732
9	185.055	28.274	-505.699	0.000	875.793	437.658	875.793	994.471
10	0.000	1.333	0.115	1.442	0.069	-0.546	1.373	1.943
11	5.140	4.712	4.370	0.000	12.385	2.597	-12.385	12.658
12	290.705	56.549	793.667	0.000	1375.150	-697.287	-1375.150	1567.056
13	547.194	84.823	374.210	0.000	1295.488	-174.072	1295.488	1405.401
14	5.140	4.712	1.835	0.000	5.165	-2.137	-5.165	8.932
15	1.851	4.712	1.936	0.000	2.732	2.705	2.732	4.345
16	0.179	1.571	0.139	0.000	0.400	-1.122	0.400	1.718
17	0.000	1.500	0.220	1.375	0.240	-0.970	1.135	1.979
18	0.000	0.667	0.320	0.888	0.147	-0.116	1.035	1.220
19	32.301	18.850	355.323	0.000	0.000	-323.022	-0.000	323.571
20	0.000	5.000	2.575	2.524	3.606	-6.110	-1.082	7.142
21	20.562	15.708	24.649	0.000	42.715	-0.765	42.715	43.866
22	0.000	15.000	7.854	-4.363	10.317	-2.862	-14.681	20.586
23	0.000	3.000	0.127	-0.707	0.468	-2.725	-0.240	3.120
24	0.364	1.571	0.133	0.000	0.546	1.478	-0.546	1.577
25	0.718	3.142	0.198	0.000	0.000	-0.916	-0.000	3.272
26	0.000	2.000	0.116	-0.726	0.283	-1.530	-0.443	2.130
27	0.000	1.333	0.207	1.150	0.339	-1.150	0.811	1.694
28	0.000	3.000	0.765	1.530	1.061	1.356	2.591	3.613
29	0.000	4.500	3.884	3.735	5.515	-0.702	9.250	9.807
30	0.000	4.500	9.321	3.759	16.108	-13.218	-12.350	18.229
31	281.989	50.265	140.493	0.000	243.775	-325.018	-243.775	461.582
32	0.000	1.000	1.000	-1.000	0.000	-1.000	-1.000	1.732