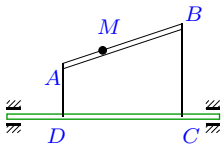
Сложное движение точки, пространственная траектория

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.)

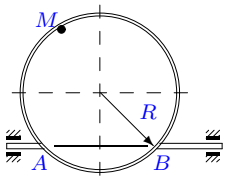
Задача 11.1. *10*



$\varphi_e = 0.15t^2$,

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

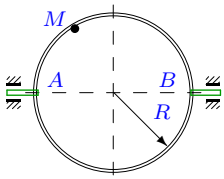
Задача 11.2. *10*



$\omega_e = 1.02$ рад/с,

$AM = \frac{3\pi}{4}(t^2 + 4)t$,
$R = 39$,
$AB = 39$,
$t = 3$ с.

Задача 11.3. *10*

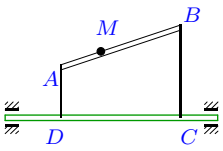


$\omega_e = 1.85$ рад/с,

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

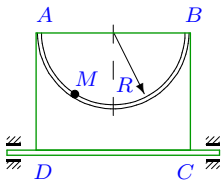
Задача 11.4. *10*

$\varphi_e = 0.14t^2$,



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

Задача 11.5. *10*

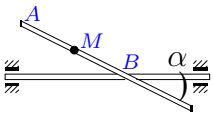


$\omega_e = 4.91$ рад/с,

$AM = \frac{5\pi}{6}(t^2 + 3)t$,
$R = 14$,
$AD = 15$,
$t = 2$ с.

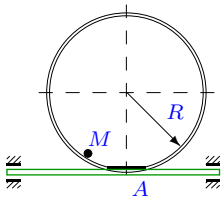
Задача 11.6. *10*

$\varphi_e = 0.14t^2$,



$AM = \frac{5}{6}(t^3 + 3)$,
$AB = 22$,
$\alpha = \pi/4$,
$t = 2$ с.

Задача 11.7. *10*

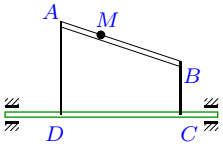


$\omega_e = 0.14$ рад/с,

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

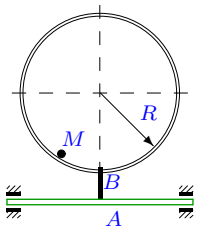
Задача 11.8. *10*

$\varphi_e = 0.08t^2$,



$AM = \frac{1}{2}(t^3 + 4)$,
$AD = 19$,
$BC = 9$,
$DC = 27$,
$t = 3$ с.

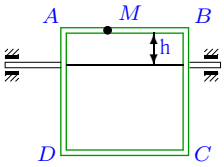
Задача 11.9. 10



$\omega_e = 0.12$ рад/с,

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

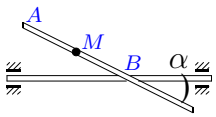
Задача 11.10. 10



$\varphi_e = 0.75t^2$,

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

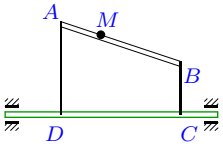
Задача 11.11. 10



$\varphi_e = 0.09t^2$,

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

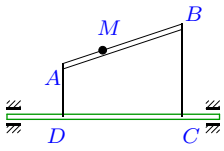
Задача 11.12. 10



$\varphi_e = 0.03t^2$,

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

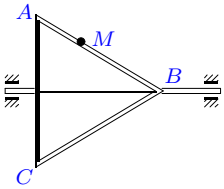
Задача 11.13. 10



$\varphi_e = 0.15t^2$,

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

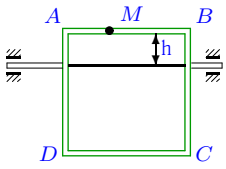
Задача 11.14. 10



$\varphi_e = 0.12t^2$,

$AM = \dfrac{5}{6}(t^2 + 4t)$,
AB=BC=AC=24,
$t = 2$ с.

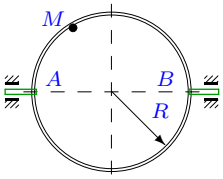
Задача 11.15. 10



$\varphi_e = 0.03t^2$,

$AM = \dfrac{1}{2}(t^2 + 52)$,
$AB = 30$,
$BC = 30$,
$h = 10$,
$t = 3$ с.

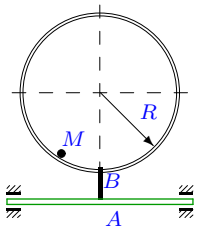
Задача 11.16. 10



$\omega_e = 0.83$ рад/с,

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

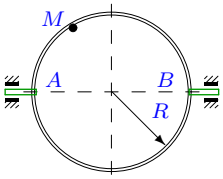
Задача 11.17. 10



$\omega_e = 0.23$ рад/с,

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

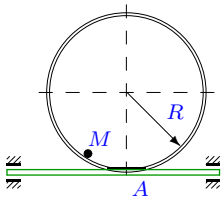
Задача 11.18. 10



$\omega_e = 1.25$ рад/с,

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

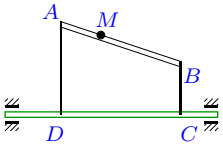
Задача 11.19. 10



$\omega_e = 0.21$ рад/с,

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

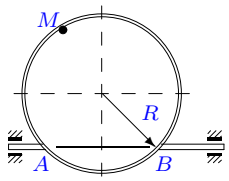
Задача 11.20. 10



$\varphi_e = 0.15t^2$,

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

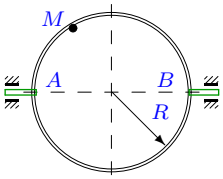
Задача 11.21. 10



$\omega_e = 10.23$ рад/с,

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

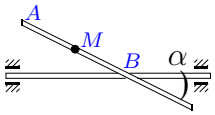
Задача 11.22. 10



$\omega_e = 1.61$ рад/с,

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

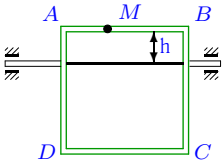
Задача 11.23. 10



$\varphi_e = 0.12t^2$,

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

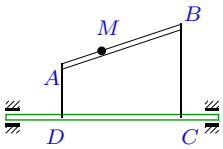
Задача 11.24. 10



$\varphi_e = 0.23t^2$,

$AM = \dfrac{1}{4}(t^2+3)t$,
$AB = 7$,
$BC = 7$,
$h = 2$,
$t = 2$ с.

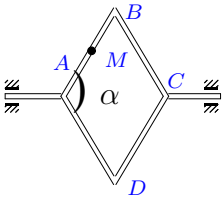
Задача 11.25. 10



$\varphi_e = 0.09t^2$,

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

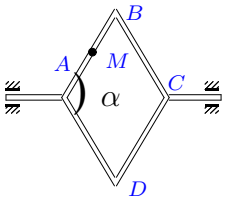
Задача 11.26. 10



$\varphi_e = 0t^2$,

$BM = \dfrac{1}{3}(t^2+52)$,
Ромб $ABCD$.
$AB = 92$,
$\alpha = 2\pi/3$,
$t = 3$ с.

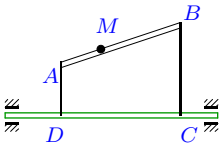
Задача 11.27. 10



$\varphi_e = 0.03t^2$,

$BM = \dfrac{1}{4}(t^2+4)t$,
Ромб $ABCD$.
$AB = 58$,
$\alpha = 2\pi/3$,
$t = 3$ с.

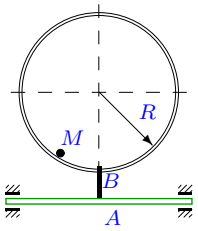
Задача 11.28. 10



$\varphi_e = 0.09t^2$,

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

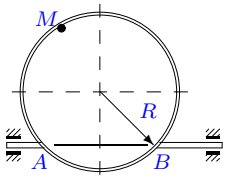
Задача 11.29. 10



$\omega_e = 1.05$ рад/с,

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

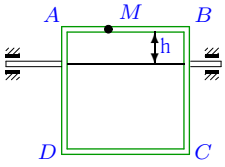
Задача 11.30. 10



$\omega_e = 6.9$ рад/с,

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

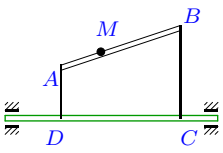
Задача 11.31. 10



$\varphi_e = 0.01t^2$,

$AM = \dfrac{1}{4}(t^2+52)$,
$AB = 30$,
$BC = 30$,
$h = 10$,
$t = 3$ с.

Задача 11.32. 10



$\varphi_e = 0.07t^2$,

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

11.10

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	3.414	2.000	-1.024	2.247	0.300	0.300
2	71.446	73.042	72.875	103.179	1.020	0.000
3	2.121	3.927	3.924	5.552	1.850	0.000
4	7.280	8.000	-4.077	8.979	0.560	0.280
5	8.000	39.270	39.280	55.543	4.910	0.000
6	9.075	10.000	-5.082	11.217	0.560	0.280
7	91.500	12.566	12.810	17.945	0.140	0.000
8	13.617	13.500	-6.536	14.999	0.480	0.160
9	77.000	9.425	9.240	13.199	0.120	0.000
10	1.000	6.000	3.000	6.708	3.000	1.500
11	36.770	20.667	19.856	28.659	0.540	0.180
12	9.957	2.500	-1.195	2.771	0.120	0.060
13	2.707	1.667	-0.812	1.854	0.300	0.300
14	7.000	6.667	-3.360	7.466	0.480	0.240
15	9.500	3.000	-1.710	3.453	0.180	0.060
16	19.500	16.232	16.185	22.922	0.830	0.000
17	83.000	18.850	19.090	26.828	0.230	0.000
18	39.000	48.695	48.750	68.904	1.250	0.000
19	30.500	6.283	6.405	8.972	0.210	0.000
20	10.925	20.250	-9.832	22.511	0.900	0.300
21	14.275	146.084	146.033	206.558	10.230	0.000
22	2.598	8.378	-4.183	9.364	1.610	0.000
23	3.536	1.667	-0.849	1.870	0.240	0.240
24	2.000	3.750	-1.840	4.177	0.920	0.460
25	2.707	1.000	-0.487	1.112	0.180	0.180
26	62.065	2.000	0.000	2.000	0.000	0.000
27	41.786	7.750	7.521	10.800	0.180	0.060
28	2.707	1.000	-0.487	1.112	0.180	0.180
29	18.000	37.699	-18.900	42.171	1.050	0.000
30	5.124	70.686	-35.358	79.036	6.900	0.000
31	10.000	1.500	-0.600	1.616	0.060	0.020
32	2.354	0.667	-0.329	0.744	0.140	0.140

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	0.000	4.000	0.307	-1.024	0.849	2.521	-1.873	4.227
2	136.798	42.412	74.333	0.000	38.566	-195.493	38.566	213.395
3	5.140	4.712	7.260	0.000	10.274	-7.563	10.274	14.536
4	0.000	8.000	2.283	-2.038	4.007	1.295	-6.045	9.456
5	110.152	31.416	192.865	0.000	333.966	-110.582	333.966	360.710
6	0.000	10.000	2.846	-2.541	7.920	-9.917	5.379	13.314
7	2.589	4.189	1.793	0.000	3.047	0.540	3.047	5.327
8	0.000	9.000	3.137	-2.179	4.501	-6.263	2.323	10.763
9	1.742	9.425	1.109	0.000	2.262	-10.534	-2.262	10.914
10	0.000	1.500	-9.000	1.500	36.000	7.500	37.500	38.243
11	0.000	12.000	10.722	6.619	15.783	-19.207	-9.164	22.911
12	0.000	2.000	0.143	-0.597	0.268	-1.038	-0.329	2.094
13	0.000	2.000	0.244	-0.812	0.707	1.171	-1.519	2.383
14	0.000	1.667	1.613	-1.680	3.200	-2.446	1.520	3.221
15	0.000	1.000	0.308	-0.570	1.080	-1.308	0.510	1.404
16	6.755	9.425	13.434	0.000	23.335	-8.649	23.335	27.035
17	6.460	9.425	4.391	0.000	8.671	-13.815	-8.671	17.544
18	60.799	28.274	60.938	0.000	0.000	-121.737	0.000	124.977
19	0.647	2.094	1.345	0.000	2.285	0.792	2.285	2.467
20	0.000	13.500	8.849	-3.277	12.660	-13.538	9.382	20.774
21	547.194	84.823	1493.919	0.000	2588.446	-1293.781	-2588.446	2939.470
22	23.395	4.189	6.734	0.000	13.488	-29.089	13.488	33.064
23	0.000	2.000	0.204	-0.849	0.566	-1.618	-0.283	2.167
24	0.000	3.000	1.693	-0.920	0.000	-1.693	-0.920	3.565
25	0.000	2.000	0.088	-0.487	0.255	1.327	-0.742	2.076
26	0.000	0.667	0.000	0.000	0.000	-0.577	0.000	0.667
27	0.000	4.500	1.354	2.507	2.416	-5.251	0.091	5.713
28	0.000	2.000	0.088	-0.487	0.255	1.327	-0.742	2.076
29	118.435	9.425	19.845	0.000	79.168	-29.270	79.168	145.435
30	356.892	56.549	243.971	0.000	844.777	-114.497	844.777	916.823
31	0.000	0.500	0.036	-0.200	0.000	-0.036	-0.200	0.540
32	0.000	0.333	0.046	-0.329	0.132	0.190	-0.461	0.552