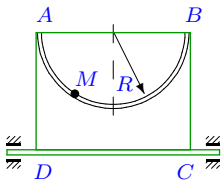
Сложное движение точки, пространственная траектория

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.)

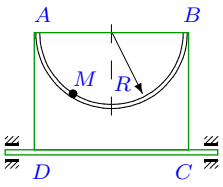
Задача 11.1. 9



$\omega_e = 1.61$ рад/с,

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

Задача 11.2. 9

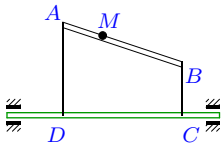


$\omega_e = 2.36$ рад/с,

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

Задача 11.3. 9

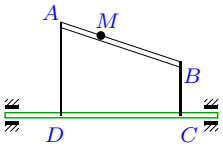
$\varphi_e = 0.19t^2$,



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

Задача 11.4. 9

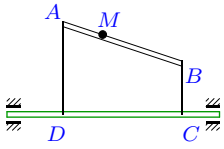
$\varphi_e = 0.01t^2$,



$AM = \frac{1}{4}(t^2 + 51)$,
$AD = 31$,
$BC = 15$,
$DC = 48$,
$t = 2$ с.

Задача 11.5. 9

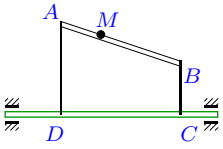
$\varphi_e = 0.37t^2$,



$AM = \frac{5}{6}(t^3 + 4)$,
$AD = 19$,
$BC = 9$,
$DC = 27$,
$t = 3$ с.

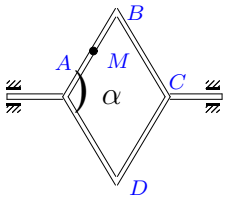
Задача 11.6. 9

$\varphi_e = 0.01t^2$,



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

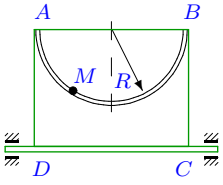
Задача 11.7. 9



$\varphi_e = 0.04t^2$,

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

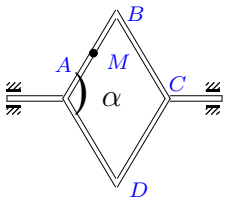
Задача 11.8. 9



$\omega_e = 5.21$ рад/с,

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

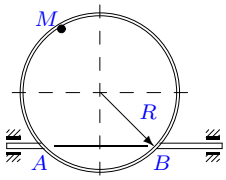
Задача 11.9. 9



$\varphi_e = 0.19t^2$,

$BM = \frac{3}{4}(t^2 + 4t)$,
Ромб $ABCD$.
$AB = 18$,
$\alpha = 2\pi/3$,
$t = 2$ с.

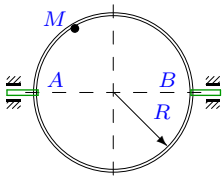
Задача 11.10. 9



$\omega_e = 6.45$ рад/с,

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

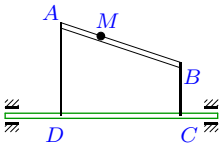
Задача 11.11. 9



$\omega_e = 0.48$ рад/с,

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

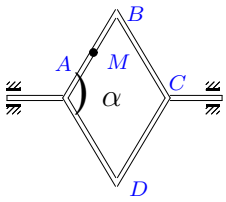
Задача 11.12. 9



$\varphi_e = 0.23t^2$,

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

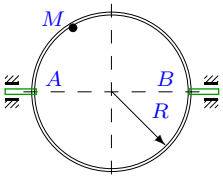
Задача 11.13. 9



$\varphi_e = 0.02t^2$,

$BM = \frac{5}{6}(t^2 + 52)$,
Ромб $ABCD$.
$AB = 92$,
$\alpha = 2\pi/3$,
$t = 3$ с.

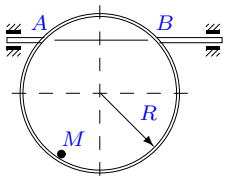
Задача 11.14. 9



$\omega_e = 3.33$ рад/с,

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

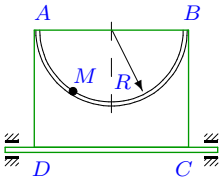
Задача 11.15. 9



$\omega_e = 0.71$ рад/с,

$AM = \frac{\pi}{4}(t^3 + 3)$,
$R = 11$,
$AB = 11$,
$t = 2$ с.

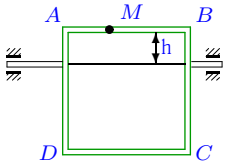
Задача 11.16. 9



$\omega_e = 0.52$ рад/с,

$AM = \frac{\pi}{6}(t^2 + 2)t$,
$R = 3$,
$AD = 4$,
$t = 1$ с.

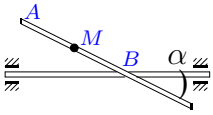
Задача 11.17. 9



$\varphi_e = 0.78t^2$,

$AM = \frac{5}{6}(t^2 + 4)t$,
$AB = 20$,
$BC = 20$,
$h = 7$,
$t = 3$ с.

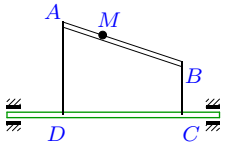
Задача 11.18. 9



$\varphi_e = 0.11t^2$,

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

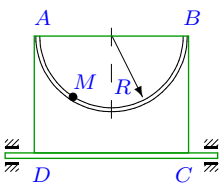
Задача 11.19. 9



$\varphi_e = 0.02t^2$,

$AM = \frac{3}{4}(t^2 + 50)$,
$AD = 29$,
$BC = 14$,
$DC = 44$,
$t = 1$ с.

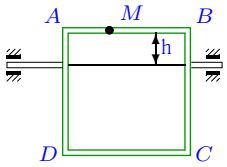
Задача 11.20. 9



$\omega_e = 18.85$ рад/с,

$AM = \frac{\pi}{2}(t^3 + 3)$,
$R = 11$,
$AD = 12$,
$t = 2$ с.

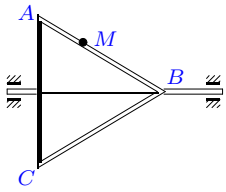
Задача 11.21. 9



$\varphi_e = 9t^2,$

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

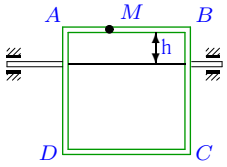
Задача 11.22. 9



$\varphi_e = 0.05t^2,$

$AM = \frac{1}{4}(t^2 + 4t),$
AB=BC=AC=24,
$t = 2$ с.

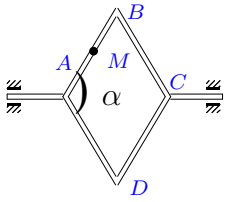
Задача 11.23. 9



$\varphi_e = 0.03t^2,$

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

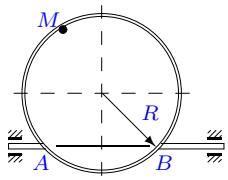
Задача 11.24. 9



$\varphi_e = 0.37t^2,$

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

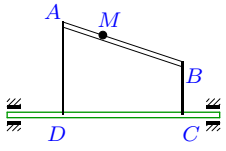
Задача 11.25. 9



$\omega_e = 0.56$ рад/с,

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

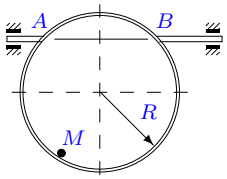
Задача 11.26. 9



$\varphi_e = 0.05t^2,$

$AM = \frac{1}{4}(t^2 + 3)t,$
$AD = 11,$
$BC = 5,$
$DC = 12,$
$t = 2$ с.

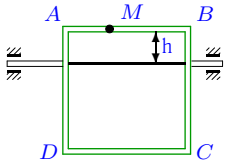
Задача 11.27. 9



$\omega_e = 5$ рад/с,

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

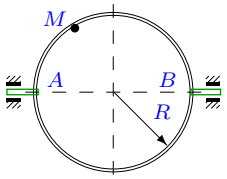
Задача 11.28. 9



$\varphi_e = 0.75t^2,$

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

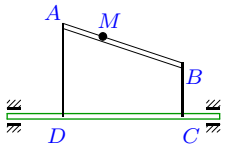
Задача 11.29. 9



$\omega_e = 2.42$ рад/с,

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

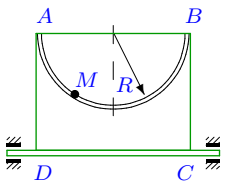
Задача 11.30. 9



$\varphi_e = 0.05t^2,$

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

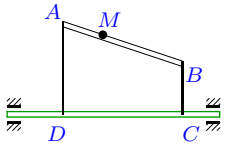
Задача 11.31. 9



$\omega_e = 1.05$ рад/с,

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

Задача 11.32. 9



$\varphi_e = 0.01t^2,$

$AM = \frac{1}{3}(t^2 + 51),$
$AD = 31,$
$BC = 15,$
$DC = 48,$
$t = 2$ с.

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	2.608	8.378	-4.198	9.371	1.610	0.000
2	1.000	4.712	-2.360	5.270	2.360	0.000
3	3.232	2.500	-1.228	2.785	0.380	0.380
4	26.652	1.000	1.066	1.462	0.040	0.020
5	10.028	22.500	22.262	31.652	2.220	0.740
6	24.886	0.500	0.498	0.705	0.020	0.020
7	14.145	5.000	-2.263	5.488	0.160	0.080
8	6.225	32.463	32.432	45.888	5.210	0.000
9	7.794	6.000	5.924	8.431	0.760	0.380
10	2.598	16.755	16.758	23.697	6.450	0.000
11	33.775	32.463	-16.212	36.286	0.480	0.000
12	6.540	6.000	6.017	8.497	0.920	0.460
13	35.651	5.000	4.278	6.580	0.120	0.040
14	2.121	7.069	7.064	9.993	3.330	0.000
15	6.679	9.425	4.742	10.551	0.710	0.000
16	2.500	2.618	-1.300	2.923	0.520	0.000
17	5.500	25.833	-25.740	36.468	4.680	1.560
18	34.471	23.250	22.751	32.530	0.660	0.220
19	16.658	1.500	-0.666	1.641	0.040	0.040
20	1.000	18.850	18.850	26.658	18.850	0.000
21	0.250	9.000	-9.000	12.728	36.000	18.000
22	10.500	2.000	2.100	2.900	0.200	0.100
23	10.000	1.500	1.800	2.343	0.180	0.060
24	1.516	2.250	-1.122	2.514	0.740	0.740
25	18.823	21.206	-10.541	23.681	0.560	0.000
26	9.435	3.750	-1.887	4.198	0.200	0.100
27	0.000	62.832	0.000	62.832	5.000	0.000
28	1.000	6.000	3.000	6.708	3.000	1.500
29	2.598	6.283	6.287	8.889	2.420	0.000
30	7.211	2.667	-1.442	3.032	0.200	0.100
31	1.879	3.927	-1.973	4.395	1.050	0.000
32	25.202	1.333	1.008	1.672	0.040	0.020

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	5.849	2.094	6.759	0.000	13.488	-2.742	13.488	14.556
2	7.402	9.425	5.570	0.000	0.000	1.833	0.000	9.601
3	0.000	5.000	0.467	-1.228	1.344	-4.002	0.115	5.341
4	0.000	0.500	0.043	0.533	0.025	-0.201	0.508	0.723
5	0.000	15.000	49.421	7.421	34.697	-54.630	-27.276	62.660
6	0.000	0.500	0.010	0.498	0.006	-0.171	0.491	0.703
7	0.000	4.000	0.362	-1.132	1.386	-3.826	0.254	4.325
8	27.022	18.850	168.972	0.000	169.133	-154.995	-169.133	231.343
9	0.000	1.500	4.502	2.962	7.898	-5.801	-4.936	7.654
10	93.578	8.378	108.086	0.000	216.142	-116.464	-216.142	262.751
11	27.022	18.850	7.782	0.000	15.582	-21.759	-15.582	40.080
12	0.000	6.000	5.536	3.009	4.937	-8.219	-1.929	10.004
13	0.000	1.667	0.513	1.426	1.039	-1.957	0.387	2.162
14	16.655	14.137	23.523	0.000	33.288	-45.296	-33.288	56.241
15	8.075	9.425	-3.367	0.000	12.927	-7.827	12.927	16.034
16	2.285	3.142	0.676	0.000	2.358	-2.254	2.358	4.821
17	0.000	15.000	-120.463	-8.580	241.800	105.463	-250.380	271.685
18	0.000	13.500	15.016	7.584	21.701	-24.562	-14.117	29.895
19	0.000	1.500	0.027	-0.666	0.039	-0.511	-0.628	1.634
20	32.301	18.850	355.323	0.000	0.000	-323.022	-0.000	323.571
21	0.000	9.000	-324.000	-4.500	648.000	315.000	-652.500	724.556
22	0.000	0.500	0.420	1.050	0.400	-0.670	0.650	1.029
23	0.000	0.500	0.324	0.600	0.000	-0.324	0.600	0.846
24	0.000	4.500	0.830	-1.122	2.884	-4.727	1.762	5.524
25	14.506	14.137	5.903	0.000	22.941	11.507	-22.941	27.675
26	0.000	3.000	0.377	-0.943	0.671	-1.719	-0.273	3.198
27	358.895	62.832	-0.000	0.000	314.159	-279.396	-314.159	481.092
28	0.000	1.500	-9.000	1.500	36.000	7.500	37.500	38.243
29	13.159	12.566	15.215	0.000	15.205	-32.895	-15.205	36.494
30	0.000	0.667	0.288	-0.721	0.477	-0.587	-0.244	0.871
31	5.140	4.712	2.071	0.000	5.831	-1.769	5.831	9.256
32	0.000	0.667	0.040	0.504	0.034	-0.251	0.470	0.827