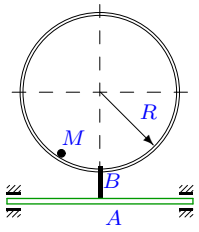
Сложное движение точки, пространственная траектория

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.)

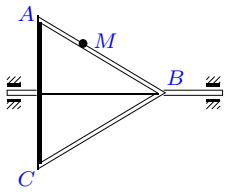
Задача 11.1. 6



$\omega_e = 0.77$ рад/с,

$BM = \dfrac{\pi}{4}(t^2 + 4)t$,
$R = 39$,
$AB = 20$,
$t = 3$ с.

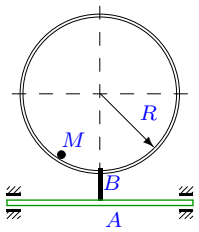
Задача 11.2. 6



$\varphi_e = 0.06t^2$,

$AM = \dfrac{1}{3}(t^3 + 4)$,
AB=BC=AC=62,
$t = 3$ с.

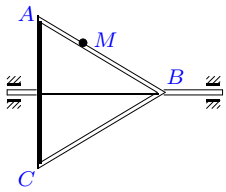
Задача 11.3. 6



$\omega_e = 0.69$ рад/с,

$BM = \dfrac{3\pi}{2}(t^2 + 6t)$,
$R = 27$,
$AB = 14$,
$t = 3$ с.

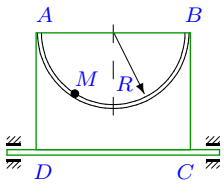
Задача 11.4. 6



$\varphi_e = 0.01t^2$,

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

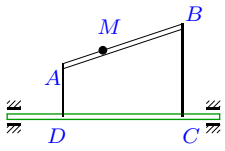
Задача 11.5. 6



$\omega_e = 0.25$ рад/с,

$AM = \dfrac{5\pi}{6}(t^2 + 52)$,
$R = 61$,
$AD = 62$,
$t = 3$ с.

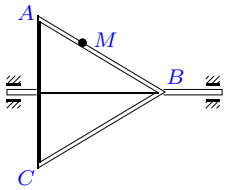
Задача 11.6. 6



$\varphi_e = 0.12t^2$,

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

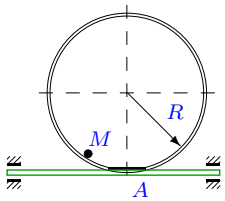
Задача 11.7. 6



$\varphi_e = 0.07t^2$,

$AM = \dfrac{1}{3}(t^2 + 4t)$,
AB=BC=AC=24,
$t = 2$ с.

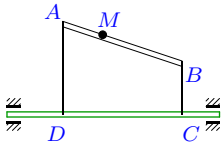
Задача 11.8. 6



$\omega_e = 3$ рад/с,

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

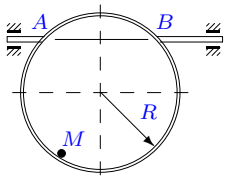
Задача 11.9. 6



$\varphi_e = 0.03t^2$,

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

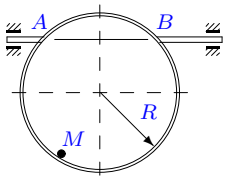
Задача 11.10. 6



$\omega_e = 5.28$ рад/с,

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

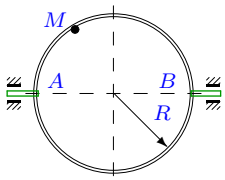
Задача 11.11. 6



$\omega_e = 0.66$ рад/с,

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

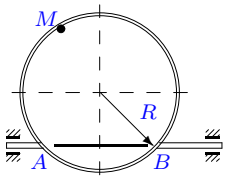
Задача 11.12. 6



$\omega_e = 0.74$ рад/с,

$AM = \dfrac{3\pi}{4}(t^2 + 6t)$,
$R = 27$,
$t = 3$ с.

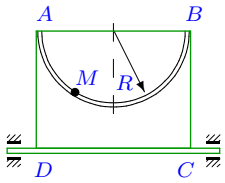
Задача 11.13. 6



$\omega_e = 0.04$ рад/с,

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

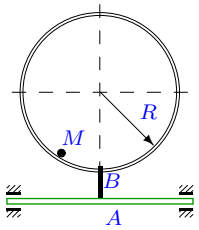
Задача 11.14. 6



$\omega_e = 3.21$ рад/с,

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

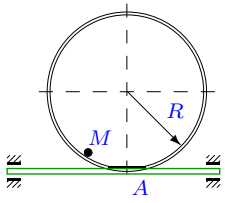
Задача 11.15. 6



$\omega_e = 0.07$ рад/с,

$BM = \dfrac{\pi}{4}(t^2 + 51)$,
$R = 55$,
$AB = 28$,
$t = 2$ с.

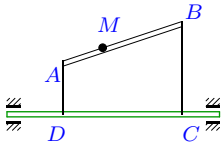
Задача 11.16. 6



$\omega_e = 1.79$ рад/с,

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

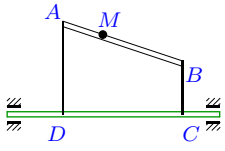
Задача 11.17. 6



$\varphi_e = 0.1t^2$,

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

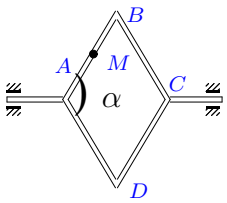
Задача 11.18. 6



$\varphi_e = 0.19t^2$,

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

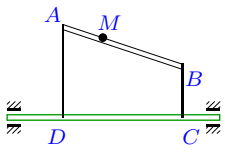
Задача 11.19. 6



$\varphi_e = 0.02t^2$,

$BM = \dfrac{1}{3}(t^2 + 6t)$,
Ромб $ABCD$.
$AB = 40$,
$\alpha = 2\pi/3$,
$t = 3$ с.

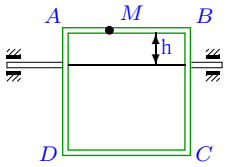
Задача 11.20. 6



$\varphi_e = 0.07t^2$,

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

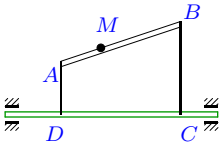
Задача 11.21. 6



$\varphi_e = 0.01t^2,$

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

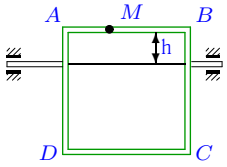
Задача 11.22. 6



$\varphi_e = 0.01t^2,$

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

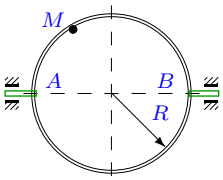
Задача 11.23. 6



$\varphi_e = 0.25t^2,$

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

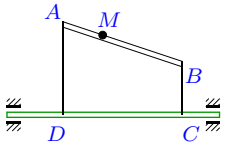
Задача 11.24. 6



$\omega_e = 2.22$ рад/с,

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

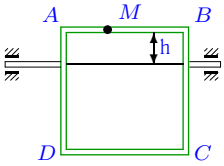
Задача 11.25. 6



$\varphi_e = 0.35t^2,$

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

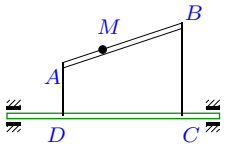
Задача 11.26. 6



$\varphi_e = 0.25t^2,$

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

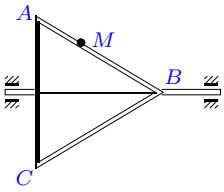
Задача 11.27. 6



$\varphi_e = 0.05t^2,$

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

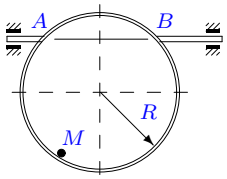
Задача 11.28. 6



$\varphi_e = 0.01t^2,$

$AM = \frac{5}{6}(t^2 + 52),$
$AB{=}BC{=}AC{=}122,$
$t = 3$ с.

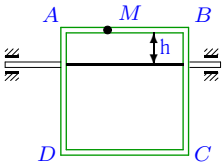
Задача 11.29. 6



$\omega_e = 2.59$ рад/с,

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

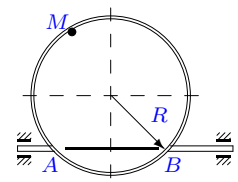
Задача 11.30. 6



$\varphi_e = 0.16t^2,$

$AM = \frac{1}{6}(t^2 + 3)t,$
$AB = 7,$
$BC = 7,$
$h = 2,$
$t = 2$ с.

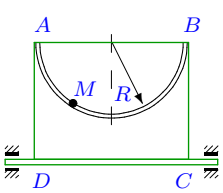
Задача 11.31. 6



$\omega_e = 1.29$ рад/с,

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

Задача 11.32. 6



$\omega_e = 3.14$ рад/с,

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

11.6

Сложное движение точки, пространственная траектория

№	R_e	v_r	v_e	v	ω_e	ε_e
1	31.423	24.347	24.196	34.325	0.770	0.000
2	25.833	9.000	9.300	12.942	0.360	0.120
3	41.000	56.549	-28.290	63.230	0.690	0.000
4	31.875	1.500	-0.638	1.630	0.020	0.020
5	31.500	15.708	-7.875	17.571	0.250	0.000
6	6.460	6.000	-3.101	6.754	0.480	0.240
7	10.000	2.667	2.800	3.867	0.280	0.140
8	21.000	62.832	62.790	88.828	2.990	0.000
9	16.308	6.750	-2.935	7.361	0.180	0.060
10	9.526	50.265	-50.299	71.110	5.280	0.000
11	9.526	12.566	6.287	14.051	0.660	0.000
12	19.092	28.274	-14.128	31.608	0.740	0.000
13	95.263	8.378	-3.811	9.203	0.040	0.000
14	2.608	16.755	-8.371	18.730	3.210	0.000
15	44.109	3.142	3.088	4.405	0.070	0.000
16	3.515	6.283	6.291	8.892	1.790	0.000
17	17.075	20.250	-10.245	22.694	0.600	0.200
18	3.586	2.667	-1.363	2.995	0.380	0.380
19	26.847	4.000	3.222	5.136	0.120	0.040
20	4.470	1.250	-0.626	1.398	0.140	0.140
21	9.000	0.333	-0.180	0.379	0.020	0.020
22	23.696	2.000	-0.948	2.213	0.040	0.020
23	1.000	0.500	0.500	0.707	0.500	0.500
24	2.121	9.425	-4.709	10.536	2.220	0.000
25	12.183	25.833	25.585	36.359	2.100	0.700
26	2.000	2.000	2.000	2.828	1.000	0.500
27	5.342	2.000	-1.068	2.267	0.200	0.100
28	35.583	5.000	-2.135	5.437	0.060	0.020
29	12.124	62.832	31.402	70.242	2.590	0.000
30	2.000	2.500	-1.280	2.809	0.640	0.320
31	5.496	7.069	7.090	10.011	1.290	0.000
32	1.879	11.781	-5.899	13.175	3.140	0.000

№	a_r^n	a_r^τ	a_e^n	a_e^τ	a_c	a_x	a_y	a
1	15.200	14.137	18.631	0.000	26.513	2.114	26.513	26.608
2	0.000	6.000	3.348	3.100	3.240	-6.348	-0.140	8.205
3	118.435	9.425	19.520	0.000	78.037	-28.945	78.037	144.757
4	0.000	1.500	0.013	-0.638	0.030	-0.763	-0.608	1.624
5	4.045	5.236	1.969	0.000	6.802	4.588	-6.802	8.252
6	0.000	6.000	1.488	-1.550	2.576	1.195	-4.126	6.874
7	0.000	0.667	0.784	1.400	0.747	-1.117	0.653	1.417
8	281.989	50.265	187.742	0.000	325.396	-372.268	-325.396	540.796
9	0.000	4.500	0.528	-0.978	0.844	-2.091	-0.135	4.712
10	229.693	50.265	-265.577	0.000	530.803	315.843	530.803	658.990
11	14.356	12.566	-4.150	0.000	16.588	-8.417	16.588	23.496
12	29.609	4.712	10.455	0.000	29.590	-34.723	29.590	48.900
13	1.276	4.189	0.152	0.000	0.335	0.837	-0.335	4.360
14	23.395	4.189	26.870	0.000	53.784	-4.515	-53.784	54.573
15	0.179	1.571	0.216	0.000	0.311	1.021	0.311	1.452
16	3.290	1.571	11.262	0.000	15.906	-7.825	15.906	17.768
17	0.000	13.500	6.147	-3.415	8.440	-1.458	-11.855	17.405
18	0.000	1.333	0.518	-1.363	1.433	-1.461	0.070	1.740
19	0.000	0.667	0.387	1.074	0.831	-0.964	0.242	1.048
20	0.000	1.500	0.088	-0.626	0.247	-1.148	-0.378	1.608
21	0.000	0.333	0.004	-0.180	0.000	-0.004	-0.180	0.379
22	0.000	1.000	0.038	-0.474	0.051	0.278	-0.525	1.119
23	0.000	1.000	0.250	0.500	0.000	-0.250	0.500	1.146
24	29.609	4.712	10.455	0.000	29.590	-34.723	29.590	48.900
25	0.000	15.000	53.729	8.528	36.111	-58.721	-27.583	66.400
26	0.000	0.500	2.000	1.000	0.000	-2.000	1.000	2.291
27	0.000	0.500	0.214	-0.534	0.358	0.010	-0.892	0.998
28	0.000	1.667	0.128	-0.712	0.300	-0.961	-0.412	1.782
29	281.989	50.265	-81.331	0.000	325.469	131.597	-325.469	450.295
30	0.000	2.000	0.819	-0.640	0.000	-0.819	-0.640	2.254
31	16.655	14.137	9.146	0.000	4.720	-21.574	4.720	28.469
32	46.264	14.137	18.523	0.000	52.315	24.187	-52.315	61.951