

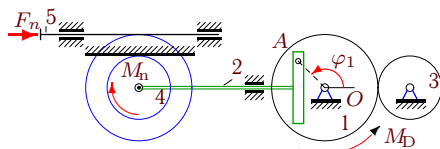
Кулиса. Уравнение Лагранжа

Кулисный механизм расположен в вертикальной плоскости и состоит из однородных цилиндров, блоков (радиус инерции i_k), штока и груза¹. Используя уравнение Лагранжа 2-го рода, получить уравнение движения механизма. Найти значение углового ускорения $\ddot{\varphi}_1$ при $t = 0$. Кинетическую энергию представить в форме $T = (\dot{\varphi}^2/2)(A + B \sin^2 \varphi)$ или $T = (\dot{\varphi}^2/2)(A + B \cos^2 \varphi)$ (варианты помечены *)

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.307.)

Задача D31.1.

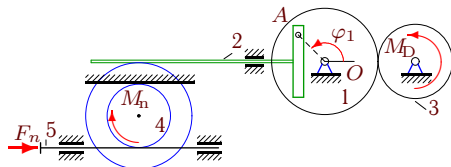
2



$$\begin{aligned} M_{D_z} &= M_0 - k\omega_{1z}, \quad M_{n_z} = -\mu\omega_{4z}, \\ F_{n_x} &= -\nu v_{5x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.5 \frac{1}{c}, \\ M_0 &= 14 \text{ Нм}, \quad k = 15 \text{ Нмс}, \\ \nu &= 8 \text{ кНс/м}, \quad \mu = 11 \text{ Нмс}, \\ I_1 &= 23 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \\ m_4 &= 28 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см}, \\ R_3 &= 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}. \end{aligned}$$

Задача D31.2.

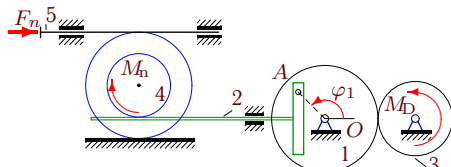
2



$$\begin{aligned} M_{D_z} &= M_0 - k\omega_{3z}, \quad M_{n_z} = -\mu\omega_{4z}, \\ F_{n_x} &= -\nu v_{5x}, \quad \varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.4 \frac{1}{c}, \\ M_0 &= 8 \text{ Нм}, \quad k = 14 \text{ Нмс}, \\ \nu &= 50 \text{ Нс/м}, \quad \mu = 13 \text{ Нмс}, \\ I_1 &= 5 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \\ m_4 &= 25 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \\ R_3 &= 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 14 \text{ см}. \end{aligned}$$

Задача D31.3.

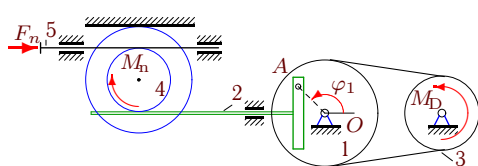
2



$$\begin{aligned} M_{D_z} &= M_0 - k\omega_{3z}, \quad M_{n_z} = -\mu\omega_{4z}, \\ F_{n_x} &= -\nu v_{5x}, \quad \varphi_{1,0} = 1.1, \quad \omega_{1z,0} = 0.4 \frac{1}{c}, \\ M_0 &= 7 \text{ Нм}, \quad k = 14 \text{ Нмс}, \\ \nu &= 30 \text{ Нс/м}, \quad \mu = 15 \text{ Нмс}, \\ I_1 &= 4 \text{ кгм}^2, \quad m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \\ m_4 &= 24 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см}, \\ R_3 &= 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}. \end{aligned}$$

Задача D31.4.

2

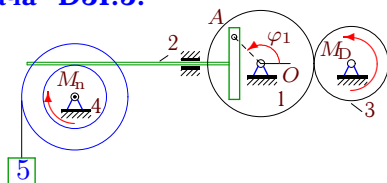


$$\begin{aligned} M_{D_z} &= M_0 - k\omega_{3z}, \quad M_{n_z} = -\mu\omega_{4z}, \\ F_{n_x} &= -\nu v_{5x}, \quad \varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.3 \frac{1}{c}, \\ M_0 &= 10 \text{ Нм}, \quad k = 13 \text{ Нмс}, \\ \nu &= 8 \text{ кНс/м}, \quad \mu = 12 \text{ Нмс}, \\ I_1 &= 9 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг}, \\ m_4 &= 26 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см}, \\ R_3 &= 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см}. \end{aligned}$$

¹В некоторых вариантах содержатся не все элементы.

Задача D31.5.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 9 \text{ Нм}, k = 11 \text{ Нмс},$$

$$\varphi_{1,0} = 1.3, \omega_{1z,0} = 0.1 \frac{1}{\text{с}},$$

$$\mu = 12 \text{ Нмс}, I_1 = 6 \text{ кгм}^2,$$

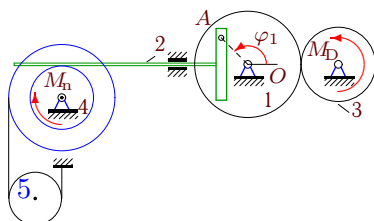
$$m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг}, m_4 = 26 \text{ кг},$$

$$m_5 = 3 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

$$R_3 = 24 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 15 \text{ см}.$$

Задача D31.6.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 10 \text{ Нм}, k = 14 \text{ Нмс},$$

$$\varphi_{1,0} = 1.4, \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$\mu = 11 \text{ Нмс}, I_1 = 7 \text{ кгм}^2,$$

$$m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг},$$

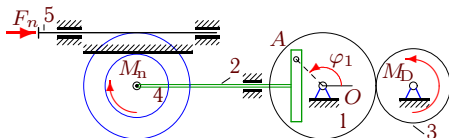
$$m_5 = 4 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 16 \text{ см},$$

$$r_5 = 10 \text{ см}.$$

Задача D31.7.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.3, \omega_{1z,0} = 0.3 \frac{1}{\text{с}},$$

$$M_0 = 9 \text{ Нм}, k = 13 \text{ Нмс},$$

$$\nu = 8 \text{ кНс/м}, \mu = 13 \text{ Нмс},$$

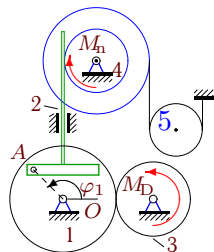
$$I_1 = 6 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

$$m_4 = 26 \text{ кг}, R_1 = 36 \text{ см}, r_1 = 25 \text{ см},$$

$$R_3 = 26 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 15 \text{ см}.$$

Задача D31.8.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 10 \text{ Нм}, k = 15 \text{ Нмс},$$

$$\varphi_{1,0} = 1.4, \omega_{1z,0} = 0.5 \frac{1}{\text{с}},$$

$$\mu = 11 \text{ Нмс}, I_1 = 7 \text{ кгм}^2,$$

$$m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг},$$

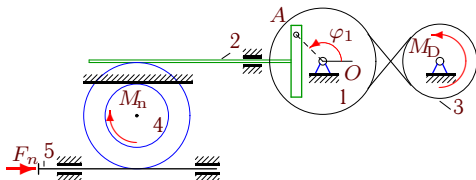
$$m_5 = 4 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 16 \text{ см},$$

$$r_5 = 10 \text{ см}.$$

Задача D31.9.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.4, \omega_{1z,0} = 0.2 \frac{1}{\text{с}},$$

$$M_0 = 12 \text{ Нм}, k = 12 \text{ Нмс},$$

$$\nu = 25 \text{ Нс/м}, \mu = 12 \text{ Нмс},$$

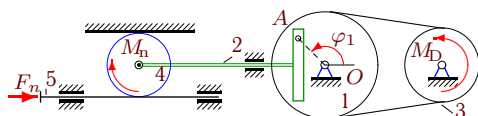
$$I_1 = 15 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

$$m_4 = 27 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

$$R_3 = 25 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 16 \text{ см}.$$

Задача D31.10.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.5, \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 12 \text{ Нм}, k = 14 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \mu = 10 \text{ Нмс},$$

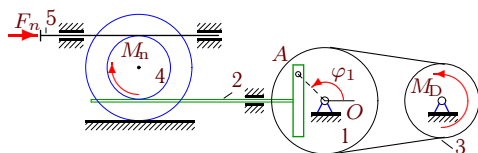
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 12 \text{ см}.$$

Задача D31.11.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.5, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$M_0 = 12 \text{ Нм}, k = 12 \text{ Нмс},$$

$$\nu = 20 \text{ Нс/м}, \mu = 10 \text{ Нмс},$$

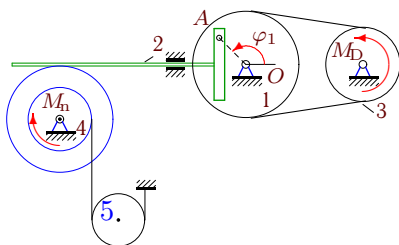
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

$$R_3 = 25 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 17 \text{ см}.$$

Задача D31.12.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 11 \text{ Нм}, k = 11 \text{ Нмс},$$

$$\varphi_{1,0} = 1.4, \omega_{1z,0} = 0.1 \frac{1}{c},$$

$$\mu = 12 \text{ Нмс}, I_1 = 11 \text{ кгм}^2,$$

$$m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг},$$

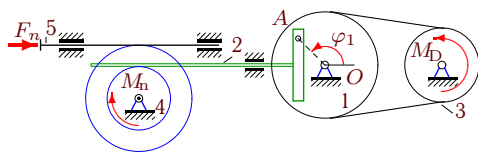
$$m_5 = 6 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

$$R_3 = 24 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 16 \text{ см},$$

$$r_5 = 11 \text{ см}.$$

Задача D31.13.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 8 \text{ Нм}, k = 14 \text{ Нмс},$$

$$\nu = 40 \text{ Нс/м}, \mu = 15 \text{ Нмс},$$

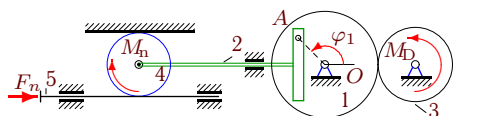
$$I_1 = 5 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 13 \text{ см}.$$

Задача D31.14.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.5, \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$M_0 = 11 \text{ Нм}, k = 13 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \mu = 10 \text{ Нмс},$$

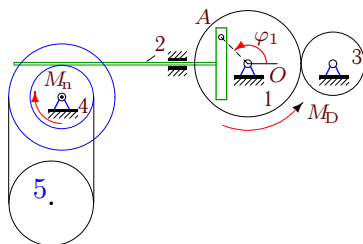
$$I_1 = 8 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, R_1 = 36 \text{ см}, r_1 = 25 \text{ см},$$

$$R_3 = 26 \text{ см}, R_4 = 12 \text{ см}.$$

Задача D31.15.

2



$$M_{Dz} = M_0 - k\omega_{1z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 13 \text{ HM}, \quad k = 15 \text{ HMC},$$

$$\varphi_{1,0} = 1.4, \quad \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$\mu = 11 \text{ HMC}, \quad I_1 = 19 \text{ кгм}^2,$$

$$m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, \quad m_4 = 27 \text{ кг},$$

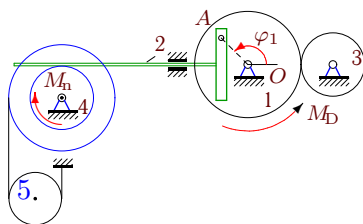
$$m_5 = 70 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см},$$

$$r_5 = 16 \text{ см}.$$

Задача D31.16.

2



$$M_{Dz} = M_0 - k\omega_{1z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 12 \text{ HM}, \quad k = 15 \text{ HMC},$$

$$\varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$\mu = 12 \text{ HMC}, \quad I_1 = 15 \text{ кгм}^2,$$

$$m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг}, \quad m_4 = 26 \text{ кг},$$

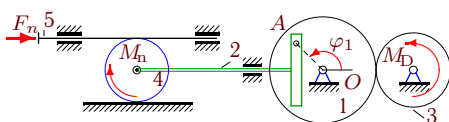
$$m_5 = 6 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см},$$

$$r_5 = 13 \text{ см}.$$

Задача D31.17.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 9 \text{ HM}, \quad k = 14 \text{ HMC},$$

$$\nu = 45 \text{ HMC/м}, \quad \mu = 13 \text{ HMC},$$

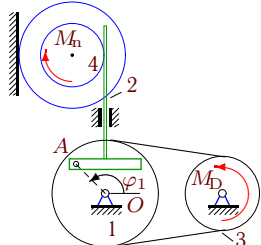
$$I_1 = 6 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

$$m_4 = 26 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 12 \text{ см}.$$

Задача D31.18.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$\varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.1 \frac{1}{c},$$

$$M_0 = 9 \text{ HM}, \quad k = 11 \text{ HMC},$$

$$\mu = 13 \text{ HMC},$$

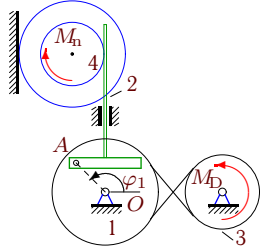
$$I_1 = 7 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, \quad R_1 = 34 \text{ см}, \quad r_1 = 23 \text{ см},$$

$$R_3 = 24 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 14 \text{ см}.$$

Задача D31.19.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$\varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 10 \text{ HM}, \quad k = 14 \text{ HMC},$$

$$\mu = 13 \text{ HMC},$$

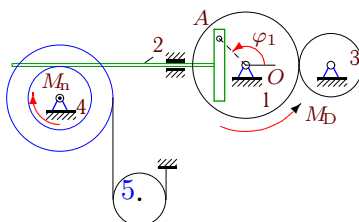
$$I_1 = 9 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 14 \text{ см}.$$

Задача D31.20.

2



$$M_{Dz} = M_0 - k\omega_{1z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 10 \text{ Нм}, k = 11 \text{ Нм/с},$$

$$\varphi_{1,0} = 1.1, \omega_{1z,0} = 0.1 \frac{1}{\text{с}},$$

$$\mu = 14 \text{ Нм/с}, I_1 = 7 \text{ кгм}^2,$$

$$m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг}, m_4 = 24 \text{ кг},$$

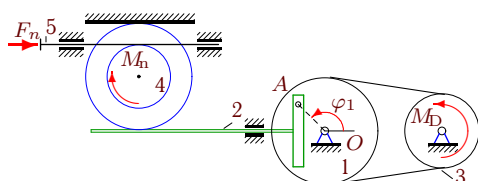
$$m_5 = 4 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

$$R_3 = 24 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 13 \text{ см},$$

$$r_5 = 13 \text{ см}.$$

Задача D31.21.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$M_0 = 9 \text{ Нм}, k = 14 \text{ Нм/с},$$

$$\nu = 8 \text{ кН/с/м}, \mu = 14 \text{ Нм/с},$$

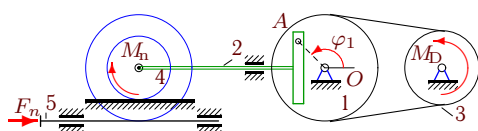
$$I_1 = 7 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.22.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$M_0 = 8 \text{ Нм}, k = 14 \text{ Нм/с},$$

$$\nu = 8 \text{ кН/с/м}, \mu = 14 \text{ Нм/с},$$

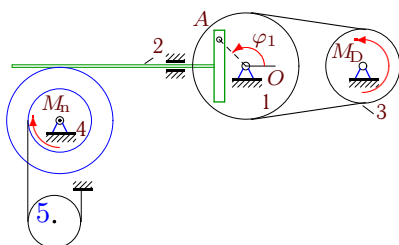
$$I_1 = 5 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 13 \text{ см}.$$

Задача D31.23.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 12 \text{ Нм}, k = 12 \text{ Нм/с},$$

$$\varphi_{1,0} = 1.5, \omega_{1z,0} = 0.2 \frac{1}{\text{с}},$$

$$\mu = 11 \text{ Нм/с}, I_1 = 13 \text{ кгм}^2,$$

$$m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг}, m_4 = 28 \text{ кг},$$

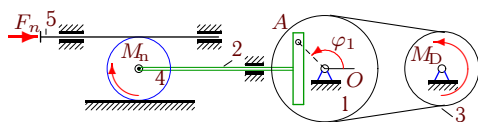
$$m_5 = 7 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

$$R_3 = 25 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 17 \text{ см},$$

$$r_5 = 11 \text{ см}.$$

Задача D31.24.

2



$$M_{Dz} = M_0 - k\omega_{3z}, M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.5, \omega_{1z,0} = 0.1 \frac{1}{\text{с}},$$

$$M_0 = 12 \text{ Нм}, k = 11 \text{ Нм/с},$$

$$\nu = 35 \text{ Н/с/м}, \mu = 11 \text{ Нм/с},$$

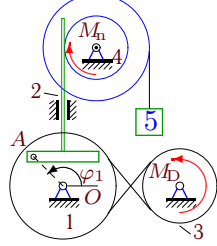
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

$$R_3 = 24 \text{ см}, R_4 = 12 \text{ см}.$$

Задача D31.25.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 13 \text{ Нм}, \quad k = 13 \text{ Нмс},$$

$$\varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$\mu = 10 \text{ Нмс}, \quad I_1 = 18 \text{ кгм}^2,$$

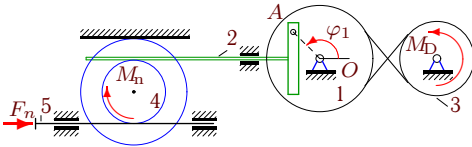
$$m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \quad m_4 = 28 \text{ кг},$$

$$m_5 = 7 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см},$$

$$R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

Задача D31.26.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 13 \text{ Нм}, \quad k = 14 \text{ Нмс},$$

$$\nu = 20 \text{ Нс/м}, \quad \mu = 10 \text{ Нмс},$$

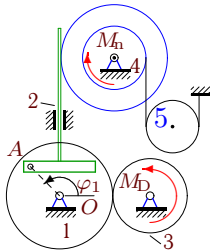
$$I_1 = 18 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

Задача D31.27.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 7 \text{ Нм}, \quad k = 15 \text{ Нмс},$$

$$\varphi_{1,0} = 1.1, \quad \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$\mu = 15 \text{ Нмс}, \quad I_1 = 4 \text{ кгм}^2,$$

$$m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \quad m_4 = 24 \text{ кг},$$

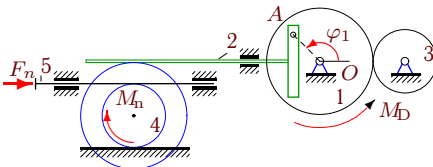
$$m_5 = 2 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см},$$

$$r_5 = 10 \text{ см}.$$

Задача D31.28.

2



$$M_{Dz} = M_0 - k\omega_{1z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.3, \quad \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$M_0 = 12 \text{ Нм}, \quad k = 12 \text{ Нмс},$$

$$\nu = 45 \text{ Нс/м}, \quad \mu = 13 \text{ Нмс},$$

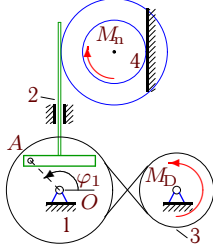
$$I_1 = 15 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

$$m_4 = 26 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см},$$

$$R_3 = 25 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 15 \text{ см}.$$

Задача D31.29.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$\varphi_{1,0} = 1.4, \quad \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$M_0 = 12 \text{ Нм}, \quad k = 13 \text{ Нмс},$$

$$\mu = 12 \text{ Нмс},$$

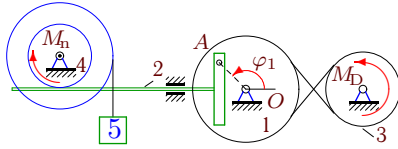
$$I_1 = 15 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг},$$

$$m_4 = 27 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см},$$

$$R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 16 \text{ см}.$$

Задача D31.30.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$M_0 = 13 \text{ Нм}, \quad k = 14 \text{ Нмс},$$

$$\varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$\mu = 10 \text{ Нмс}, \quad I_1 = 18 \text{ кгм}^2,$$

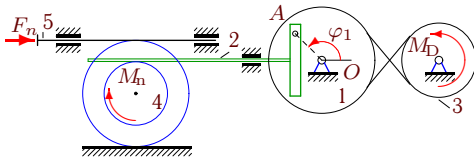
$$m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \quad m_4 = 28 \text{ кг},$$

$$m_5 = 7 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

Задача D31.31.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$M_0 = 13 \text{ Нм}, \quad k = 14 \text{ Нмс},$$

$$\nu = 10 \text{ Нс/м}, \quad \mu = 11 \text{ Нмс},$$

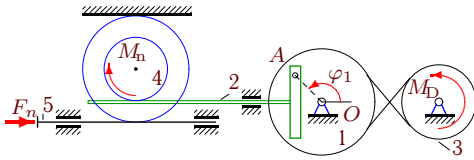
$$I_1 = 18 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

Задача D31.32.

2



$$M_{Dz} = M_0 - k\omega_{3z}, \quad M_{nz} = -\mu\omega_{4z},$$

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

$$M_0 = 13 \text{ Нм}, \quad k = 14 \text{ Нмс},$$

$$\nu = 10 \text{ Нс/м}, \quad \mu = 11 \text{ Нмс},$$

$$I_1 = 18 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

$$m_4 = 28 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

D31 Ответы.
Кулиса. Уравнение Лагранжа

23.03.2012

	A	B	Q	ε	B_2	B_4	B_5	Q_F	Q_M	Q_D	Q_T
1	25.599	7.450	-150.156	-4.553	1.31	6.14	0.00	-128.95	-27.70	6.50	0.00
2	7.259	9.992	-79.763	-5.038	1.01	8.98	0.00	-10.57	-47.71	-21.48	0.00
3	6.190	15.371	-86.552	-4.758	0.95	14.42	0.00	-16.11	-50.34	-20.11	0.00
4	11.203	1.992	-4.375	-0.339	1.00	0.99	0.00	-8.70	-2.04	6.37	0.00
5	7.965	3.436	-8.180	-0.734	0.85	2.15	0.44	0.00	-4.09	-14.96	10.87
6	9.396	4.676	-35.901	-2.585	1.15	3.24	0.28	0.00	-20.06	-24.22	8.38
7	8.203	5.164	-97.551	-7.514	1.00	4.16	0.00	-61.90	-15.72	-19.94	0.00
8*	9.527	5.042	-34.342	-3.529	1.24	3.50	0.30	0.00	-0.80	-27.39	-6.15
9	17.144	10.699	-46.955	-1.708	0.98	9.72	0.00	-4.47	-20.98	-21.50	0.00
10	15.464	4.056	-16.522	-0.850	1.22	2.84	0.00	-3.77	-18.68	5.93	0.00
11	15.205	18.400	-9.482	-0.284	1.04	17.36	0.00	-3.67	-17.91	12.10	0.00
12	13.023	1.856	7.832	0.528	0.90	0.91	0.04	0.00	-1.54	13.38	-4.00
13	7.190	2.850	-24.311	-2.591	0.95	1.90	0.00	-2.39	-22.37	0.45	0.00
14	10.333	3.750	-38.275	-2.723	1.13	2.63	0.00	-2.61	-12.96	-22.71	0.00
15	21.527	9.841	39.364	1.253	1.24	3.50	5.10	0.00	-27.04	5.50	60.90
16	17.455	4.584	-10.941	-0.518	1.17	2.96	0.46	0.00	-28.20	4.50	12.76
17	8.327	3.718	-50.033	-4.261	1.08	2.64	0.00	-4.52	-22.66	-22.85	0.00
18*	8.907	1.563	-14.584	-1.600	0.79	0.77	0.00	0.00	-0.09	10.54	-25.04
19*	11.259	1.998	-52.975	-4.589	1.01	0.98	0.00	0.00	-0.45	-24.22	-28.30
20	8.850	2.451	-1.888	-0.176	0.74	1.49	0.22	0.00	-4.08	8.90	-6.70
21	9.259	1.644	-7.755	-0.734	1.01	0.63	0.00	-7.52	-2.06	1.82	0.00
22	7.190	4.473	-96.794	-9.037	0.95	3.53	0.00	-76.36	-20.88	0.45	0.00
23	15.205	2.256	13.876	0.795	1.04	1.17	0.05	0.00	-3.15	12.10	4.93
24	15.081	3.174	10.035	0.550	0.95	2.22	0.00	-0.74	-4.02	14.79	0.00
25*	20.333	5.852	-26.641	-1.307	1.13	3.51	1.22	0.00	-0.07	-25.48	-1.10
26	20.464	21.594	-78.979	-1.889	1.22	20.38	0.00	-8.61	-42.04	-28.33	0.00
27*	6.310	1.779	-42.225	-6.298	1.02	0.74	0.02	0.00	-2.81	-23.31	-16.10
28	17.082	1.461	7.971	0.431	0.92	0.54	0.00	-0.27	-1.36	9.60	0.00
29*	17.268	1.722	-35.463	-2.046	1.06	0.66	0.00	0.00	-0.06	-24.09	-11.31
30	20.464	6.330	-17.332	-0.650	1.22	3.80	1.31	0.00	-18.68	-28.33	29.68
31	20.464	2.490	-31.642	-1.380	1.22	1.27	0.00	-0.42	-2.89	-28.33	0.00
32	20.464	2.490	-31.642	-1.380	1.22	1.27	0.00	-0.42	-2.89	-28.33	0.00

D31 файл o31d2A