

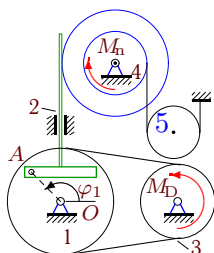
Кулиса. Уравнение Лагранжа

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.

8



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

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

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

$$\mu = 11 \text{ Нмс}, \quad I_1 = 13 \text{ кгм}^2,$$

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

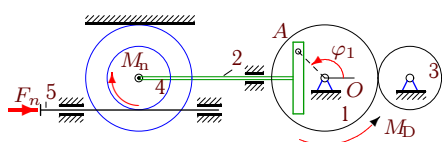
$$m_5 = 7 \text{ кг}, \quad R_1 = 35 \text{ см}, \quad r_1 = 24 \text{ см},$$

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

$$r_5 = 11 \text{ см}.$$

Задача D31.2.

8



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

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

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

$$\nu = 30 \text{ Нс/м}, \quad \mu = 12 \text{ Нмс},$$

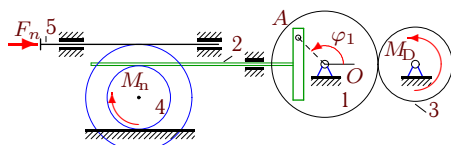
$$I_1 = 15 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

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

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

Задача D31.3.

8



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

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.5 \frac{1}{\text{с}},$$

$$M_0 = 8 \text{ Нм}, \quad k = 15 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \quad \mu = 14 \text{ Нмс},$$

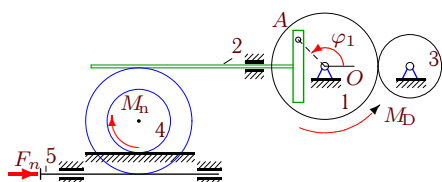
$$I_1 = 5 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 14 \text{ см}.$$

Задача D31.4.

8



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

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.5, \quad \omega_{1z,0} = 0.5 \frac{1}{\text{с}},$$

$$M_0 = 14 \text{ Нм}, \quad k = 15 \text{ Нмс},$$

$$\nu = 8 \text{ кНс/м}, \quad \mu = 10 \text{ Нмс},$$

$$I_1 = 23 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

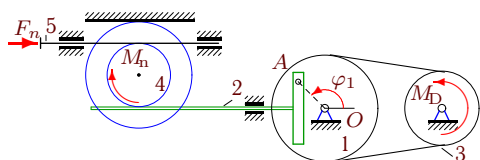
$$m_4 = 28 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

¹В некоторых вариантах содержатся не все элементы.

Задача D31.5.

8



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

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

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

$$\nu = 8 \text{ кНс/м}, \mu = 10 \text{ Нмс},$$

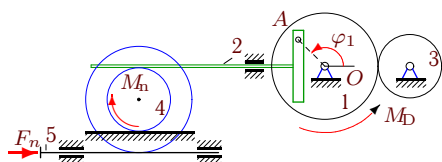
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

$$R_3 = 24 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 17 \text{ см}.$$

Задача D31.6.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$M_0 = 11 \text{ Нм}, k = 15 \text{ Нмс},$$

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

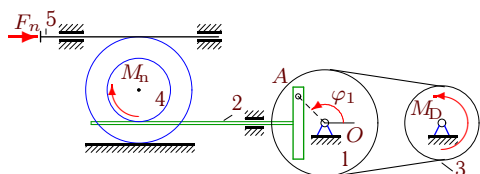
$$I_1 = 11 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.7.

8



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

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

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

$$\nu = 25 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

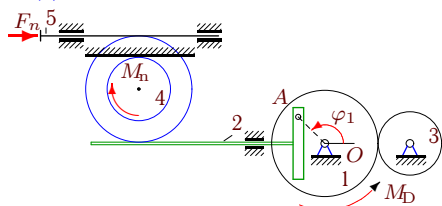
$$I_1 = 7 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

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

Задача D31.8.

8



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

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

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

$$\nu = 8 \text{ кНс/м}, \mu = 11 \text{ Нмс},$$

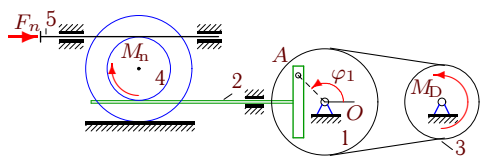
$$I_1 = 23 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.9.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$M_0 = 9 \text{ Нм}, k = 15 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \mu = 13 \text{ Нмс},$$

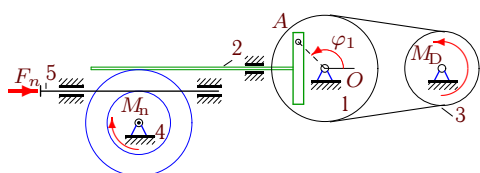
$$I_1 = 7 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.10.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.4, \omega_{1z,0} = 0.4 \frac{1}{c},$$

$$M_0 = 11 \text{ Нм}, k = 14 \text{ Нмс},$$

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

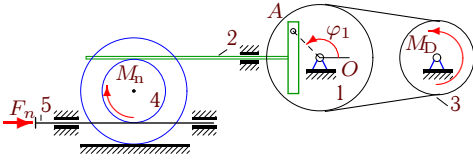
$$I_1 = 11 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

$$m_4 = 27 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

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

Задача D31.11.

8



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

$$F_{n_x} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$M_0 = 9 \text{ Нм}, k = 12 \text{ Нмс},$$

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

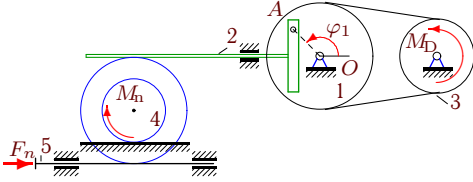
$$I_1 = 7 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

$$R_3 = 25 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.12.

8



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

$$F_{n_x} = -\nu v_{5x}, \varphi_{1,0} = 1.4, \omega_{1z,0} = 0.3 \frac{1}{c},$$

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

$$\nu = 8 \text{ кНс/м}, \mu = 11 \text{ Нмс},$$

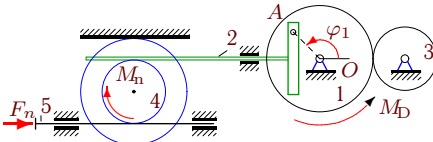
$$I_1 = 11 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.13.

8



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

$$F_{n_x} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.1 \frac{1}{c},$$

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

$$\nu = 40 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

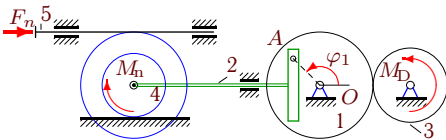
$$I_1 = 7 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

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

Задача D31.14.

8



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

$$F_{n_x} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$M_0 = 8 \text{ Нм}, k = 15 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

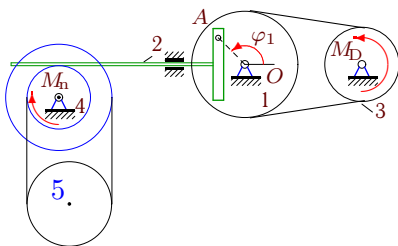
$$I_1 = 5 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

$$m_4 = 25 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.15.

8



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

$$M_0 = 10 \text{ Нм}, k = 12 \text{ Нмс},$$

$$\varphi_{1,0} = 1.3, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$\mu = 12 \text{ Нмс}, I_1 = 9 \text{ кгм}^2,$$

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

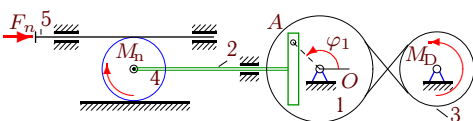
$$m_5 = 40 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

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

$$r_5 = 16 \text{ см}.$$

Задача D31.16.

8



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

$$F_{n_x} = -\nu v_{5x}, \varphi_{1,0} = 1.3, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$M_0 = 11 \text{ Нм}, k = 15 \text{ Нмс},$$

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

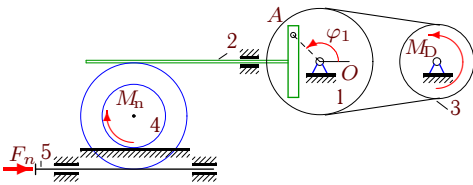
$$I_1 = 12 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

$$m_4 = 26 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 12 \text{ см}.$$

Задача D31.17.

8



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

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

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

$$\nu = 8 \text{ кНс/м}, \mu = 10 \text{ Нмс},$$

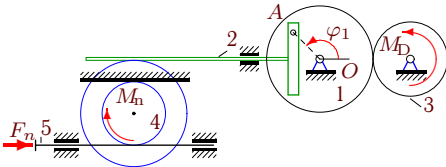
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.18.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$M_0 = 8 \text{ Нм}, k = 13 \text{ Нмс},$$

$$\nu = 50 \text{ Нс/м}, \mu = 13 \text{ Нмс},$$

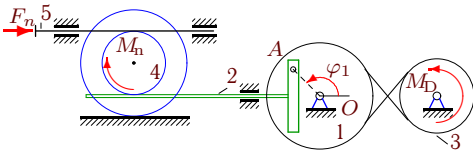
$$I_1 = 5 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

$$R_3 = 26 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.19.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$M_0 = 10 \text{ Нм}, k = 13 \text{ Нмс},$$

$$\nu = 35 \text{ Нс/м}, \mu = 13 \text{ Нмс},$$

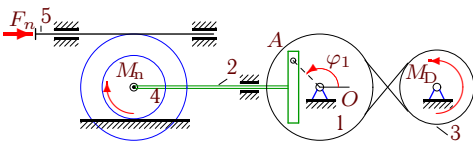
$$I_1 = 9 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

$$R_3 = 26 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 14 \text{ см}.$$

Задача D31.20.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$M_0 = 9 \text{ Нм}, k = 12 \text{ Нмс},$$

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

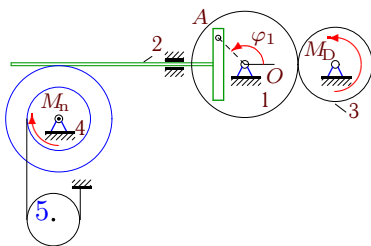
$$I_1 = 6 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

$$R_3 = 25 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 13 \text{ см}.$$

Задача D31.21.

8



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

$$M_0 = 9 \text{ Нм}, k = 12 \text{ Нмс},$$

$$\varphi_{1,0} = 1.3, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$\mu = 13 \text{ Нмс}, I_1 = 6 \text{ кгм}^2,$$

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

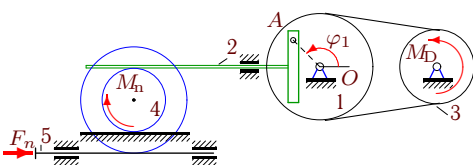
$$m_5 = 4 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

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

$$r_5 = 10 \text{ см}.$$

Задача D31.22.

8



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

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

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

$$\nu = 8 \text{ кНс/м}, \mu = 10 \text{ Нмс},$$

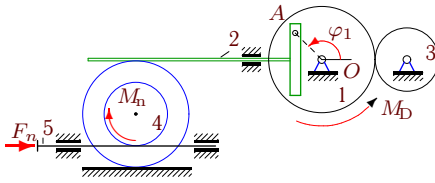
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.23.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.4, \omega_{1z,0} = 0.1 \frac{1}{c},$$

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

$$\nu = 8 \text{ Нс/м}, \mu = 11 \text{ Нмс},$$

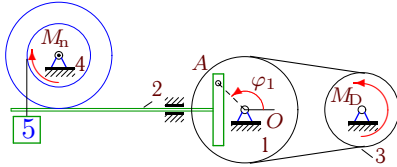
$$I_1 = 19 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

$$m_4 = 27 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

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

Задача D31.24.

8



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

$$M_0 = 12 \text{ Нм}, k = 15 \text{ Нмс},$$

$$\varphi_{1,0} = 1.5, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$\mu = 11 \text{ Нмс}, I_1 = 13 \text{ кгм}^2,$$

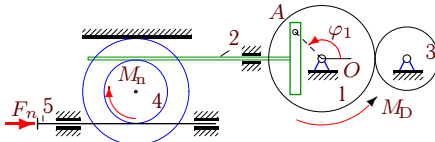
$$m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг}, m_4 = 28 \text{ кг},$$

$$m_5 = 7 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 17 \text{ см}.$$

Задача D31.25.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.5 \frac{1}{c},$$

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

$$\nu = 40 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

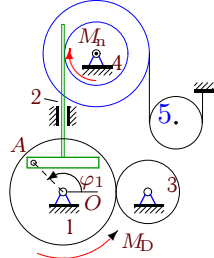
$$I_1 = 7 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

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

Задача D31.26.

8



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

$$M_0 = 14 \text{ Нм}, k = 15 \text{ Нмс},$$

$$\varphi_{1,0} = 1.5, \omega_{1z,0} = 0.5 \frac{1}{c},$$

$$\mu = 10 \text{ Нмс}, I_1 = 23 \text{ кгм}^2,$$

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

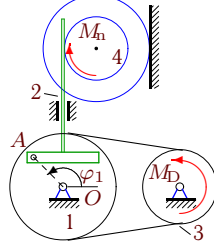
$$m_5 = 8 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

$$R_3 = 28 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 17 \text{ см},$$

$$r_5 = 13 \text{ см}.$$

Задача D31.27.

8



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

$$\varphi_{1,0} = 1.5, \omega_{1z,0} = 0.4 \frac{1}{c},$$

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

$$\mu = 10 \text{ Нмс},$$

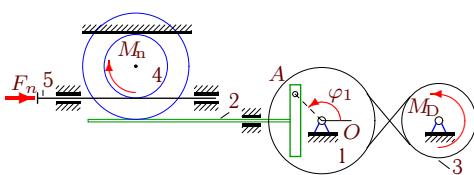
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.28.

8



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

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

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

$$\nu = 55 \text{ Нс/м}, \mu = 15 \text{ Нмс},$$

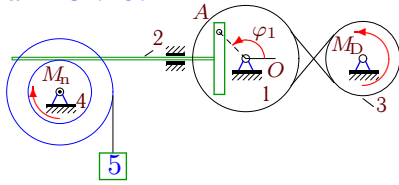
$$I_1 = 6 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

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

Задача D31.29.

8



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

$$M_0 = 11 \text{ Нм}, k = 14 \text{ Нмс},$$

$$\varphi_{1,0} = 1.3, \omega_{1z,0} = 0.4 \frac{1}{\text{с}},$$

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

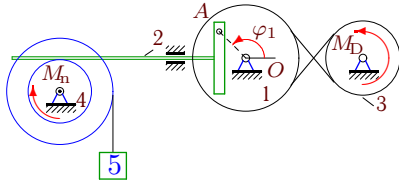
$$m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг}, m_4 = 26 \text{ кг},$$

$$m_5 = 5 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

$$R_3 = 27 \text{ см}, R_4 = 20 \text{ см}, r_4 = 12 \text{ см}, i_4 = 15 \text{ см}.$$

Задача D31.30.

8



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

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

$$\varphi_{1,0} = 1.2, \omega_{1z,0} = 0.1 \frac{1}{\text{с}},$$

$$\mu = 13 \text{ Нмс}, I_1 = 9 \text{ кгм}^2,$$

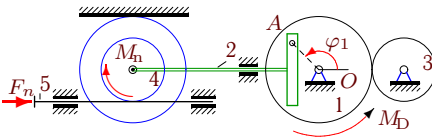
$$m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг}, m_4 = 25 \text{ кг},$$

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

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

Задача D31.31.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.1, \omega_{1z,0} = 0.5 \frac{1}{\text{с}},$$

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

$$\nu = 40 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

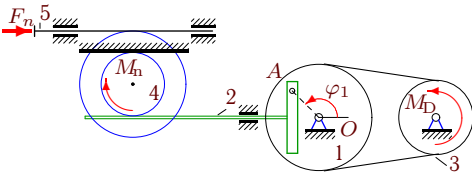
$$I_1 = 7 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

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

Задача D31.32.

8



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.3, \omega_{1z,0} = 0.1 \frac{1}{\text{с}},$$

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

$$\nu = 8 \text{ Нс/м}, \mu = 12 \text{ Нмс},$$

$$I_1 = 9 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

$$m_4 = 26 \text{ кг}, R_1 = 34 \text{ см}, r_1 = 23 \text{ см},$$

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

D31 Ответы.
Кулиса. Уравнение Лагранжа

21.03.2012

	A	B	Q	ε	B_2	B_4	B_5	Q_F	Q_M	Q_D	Q_T
1*	15.205	2.256	9.432	0.620	1.04	1.17	0.05	0.00	-0.02	12.10	-2.65
2	17.082	3.262	5.570	0.275	0.92	2.34	0.00	-0.82	-3.21	9.60	0.00
3	7.383	2.169	-34.337	-3.725	1.09	1.08	0.00	-1.97	-7.70	-24.67	0.00
4	25.599	2.175	-15.176	-0.548	1.31	0.86	0.00	-18.13	-3.54	6.50	0.00
5	15.081	1.949	11.647	0.684	0.95	1.00	0.00	-2.63	-0.51	14.79	0.00
6	13.383	2.169	-31.792	-2.094	1.09	1.08	0.00	-28.15	-7.15	3.50	0.00
7	9.259	16.752	-64.247	-2.736	1.01	15.74	0.00	-14.68	-51.38	1.82	0.00
8	25.333	1.865	-1.232	-0.046	1.13	0.74	0.00	-9.33	-2.00	10.10	0.00
9	9.383	18.066	-83.649	-3.397	1.09	16.97	0.00	-17.73	-64.32	-1.60	0.00
10	13.396	2.317	-3.556	-0.231	1.15	1.17	0.00	-0.24	-7.88	4.56	0.00
11	9.021	1.702	1.622	0.152	0.86	0.84	0.00	-5.00	-1.27	7.90	0.00
12	13.268	1.722	-3.306	-0.223	1.06	0.66	0.00	-9.10	-1.96	7.75	0.00
13	8.850	12.028	-2.980	-0.165	0.74	11.29	0.00	-2.69	-9.19	8.90	0.00
14	7.383	5.397	-63.336	-5.285	1.09	4.30	0.00	-7.88	-30.78	-24.67	0.00
15	11.083	5.566	-29.865	-1.841	0.92	2.34	2.30	0.00	-8.91	9.30	-30.25
16	14.455	4.010	-65.385	-3.611	1.17	2.84	0.00	-6.09	-30.55	-28.74	0.00
17	15.464	2.017	-10.152	-0.582	1.22	0.80	0.00	-13.45	-2.63	5.93	0.00
18	7.138	9.238	-58.969	-3.907	0.94	8.30	0.00	-7.33	-33.09	-18.55	0.00
19	11.138	15.488	-63.530	-2.602	0.94	14.55	0.00	-9.12	-33.09	-21.32	0.00
20	7.960	3.811	-29.438	-2.685	0.81	3.00	0.00	-2.60	-9.53	-17.30	0.00
21	8.083	1.795	-18.058	-1.854	0.92	0.84	0.03	0.00	-3.48	-17.30	2.72
22	15.205	2.249	-0.083	-0.005	1.04	1.21	0.00	-10.19	-1.99	12.10	0.00
23	21.023	1.485	9.903	0.441	0.90	0.59	0.00	-1.64	-0.35	11.90	0.00
24	15.599	2.971	-18.598	-1.005	1.31	1.47	0.18	0.00	-9.97	2.47	-11.10
25	9.310	16.576	-79.357	-3.605	1.02	15.56	0.00	-18.53	-63.33	2.50	0.00
26*	25.599	6.016	4.250	0.170	1.31	4.10	0.61	0.00	-0.13	6.50	-2.12
27*	15.464	2.490	-0.490	-0.030	1.22	1.27	0.00	0.00	-0.01	5.93	-6.40
28	8.190	1.442	-26.660	-2.866	0.95	0.50	0.00	-0.66	-3.15	-22.85	0.00
29	14.327	4.767	-66.992	-3.583	1.08	2.75	0.94	0.00	-20.92	-25.59	-20.48
30	10.907	3.181	-34.543	-2.527	0.79	1.80	0.59	0.00	-4.15	-16.37	-14.02
31	9.310	3.509	-10.597	-0.905	1.02	2.49	0.00	-2.96	-10.13	2.50	0.00
32	10.965	1.728	6.570	0.522	0.85	0.88	0.00	-4.37	-1.02	11.96	0.00

D31 файл о31d8A