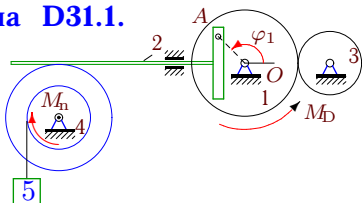


Кулиса. Уравнение Лагранжа

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.



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

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

$$\varphi_{1,0} = 1.2, \quad \omega_{1z,0} = 0.3 \frac{1}{\text{с}},$$

$$\mu = 14 \text{ Нмс}, \quad I_1 = 11 \text{ кгм}^2,$$

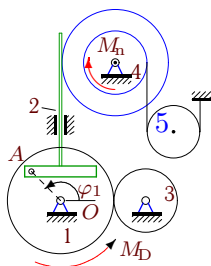
$$m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \quad m_4 = 25 \text{ кг},$$

$$m_5 = 6 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см},$$

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

3

Задача D31.2.



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

$$M_0 = 13 \text{ Нм}, \quad k = 15 \text{ Нмс},$$

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

$$\mu = 12 \text{ Нмс}, \quad I_1 = 19 \text{ кгм}^2,$$

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

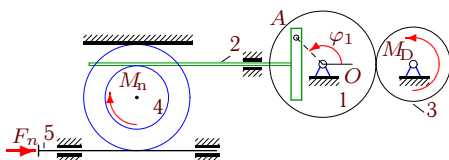
$$m_5 = 8 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

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

$$r_5 = 13 \text{ см}.$$

3

Задача D31.3.



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

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.1, \quad \omega_{1z,0} = 0.3 \frac{1}{\text{с}},$$

$$M_0 = 7 \text{ Нм}, \quad k = 13 \text{ Нмс},$$

$$\nu = 30 \text{ Нс/м}, \quad \mu = 14 \text{ Нмс},$$

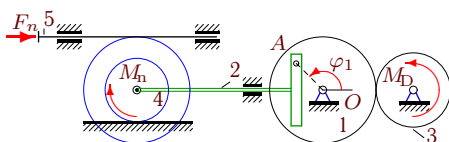
$$I_1 = 4 \text{ кгм}^2, \quad m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг},$$

$$m_4 = 24 \text{ кг}, \quad R_1 = 36 \text{ см}, \quad r_1 = 25 \text{ см},$$

$$R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 13 \text{ см}.$$

3

Задача D31.4.



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

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

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

$$\nu = 20 \text{ Нс/м}, \quad \mu = 11 \text{ Нмс},$$

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

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

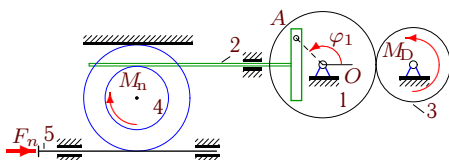
$$R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

3

¹В некоторых вариантах содержатся не все элементы.

Задача D31.5.

3



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

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

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

$$\nu = 15 \text{ Нс/м}, \mu = 11 \text{ Нмс},$$

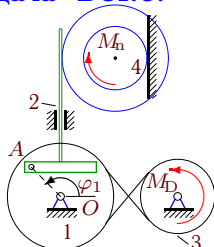
$$I_1 = 7 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.6.

3



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

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

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

$$\mu = 11 \text{ Нмс},$$

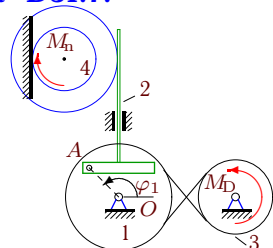
$$I_1 = 18 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.7.

3



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

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

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

$$\mu = 13 \text{ Нмс},$$

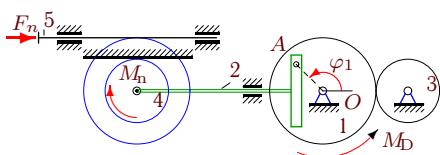
$$I_1 = 12 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

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

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

Задача D31.8.

3



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

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

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

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

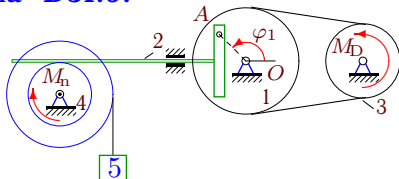
$$I_1 = 23 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.9.

3



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

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

$$\varphi_{1,0} = 1.2, \omega_{1z,0} = 0.3 \frac{1}{c},$$

$$\mu = 13 \text{ Нмс}, I_1 = 7 \text{ кгм}^2,$$

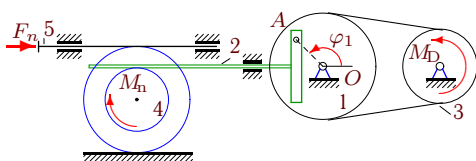
$$m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг}, m_4 = 25 \text{ кг},$$

$$m_5 = 3 \text{ кг}, R_1 = 36 \text{ см}, r_1 = 25 \text{ см},$$

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

Задача D31.10.

3



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

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

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

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

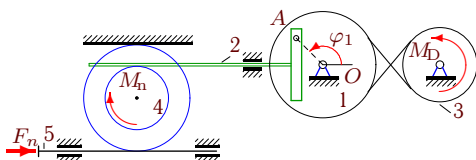
$$I_1 = 13 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.11.

3



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.4, \omega_{1z,0} = 0.5 \frac{1}{c},$$

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

$$\nu = 15 \text{ Нс/м}, \mu = 11 \text{ Нмс},$$

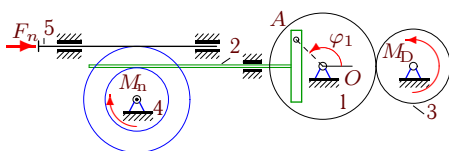
$$I_1 = 15 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.12.

3



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

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

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

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

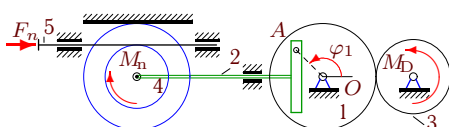
$$I_1 = 7 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.13.

3



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

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

$$M_0 = 7 \text{ Нм}, k = 12 \text{ Нмс},$$

$$\nu = 8 \text{ Нс/м}, \mu = 15 \text{ Нмс},$$

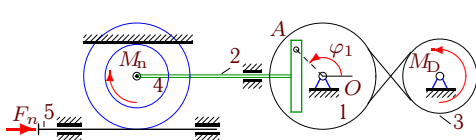
$$I_1 = 4 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

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

Задача D31.14.

3



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

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

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

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

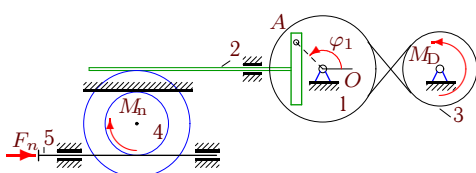
$$I_1 = 18 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.15.

3



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

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

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

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

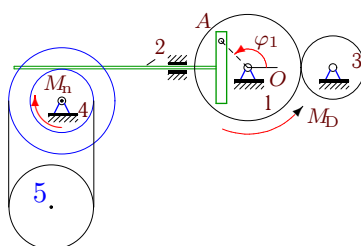
$$I_1 = 18 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.16.

3



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

$$M_0 = 13 \text{ Нм}, k = 15 \text{ Нмс},$$

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

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

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

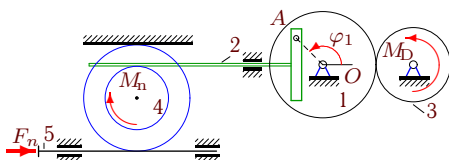
$$m_5 = 70 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

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

$$r_5 = 16 \text{ см}.$$

Задача D31.17.

3



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

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

$$M_0 = 7 \text{ Нм}, k = 11 \text{ Нмс},$$

$$\nu = 30 \text{ Нс/м}, \mu = 14 \text{ Нмс},$$

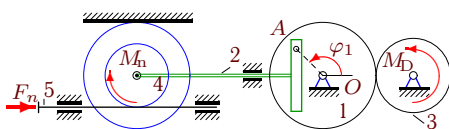
$$I_1 = 4 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

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

Задача D31.18.

3



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

$$F_{nx} = -\nu v_{5x}, \varphi_{1,0} = 1.2, \omega_{1z,0} = 0.1 \frac{1}{c},$$

$$M_0 = 8 \text{ Нм}, k = 11 \text{ Нмс},$$

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

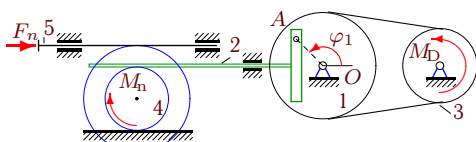
$$I_1 = 5 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

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

Задача D31.19.

3



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

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

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

$$\nu = 30 \text{ Нс/м}, \mu = 13 \text{ Нмс},$$

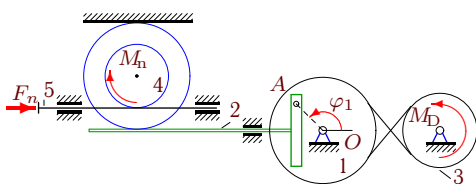
$$I_1 = 9 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

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

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

Задача D31.20.

3



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

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

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

$$\nu = 30 \text{ Нс/м}, \mu = 13 \text{ Нмс},$$

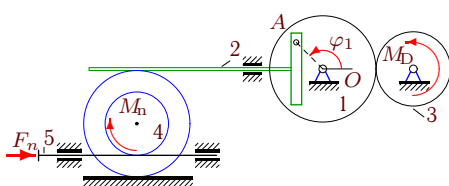
$$I_1 = 12 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

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

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

Задача D31.21.

3



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

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

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

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

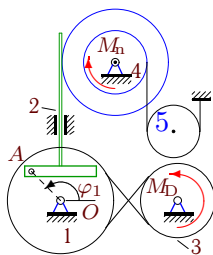
$$I_1 = 8 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.22.

3



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

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

$$\varphi_{1,0} = 1.1, \omega_{1z,0} = 0.2 \frac{1}{c},$$

$$\mu = 15 \text{ Нмс}, I_1 = 6 \text{ кгм}^2,$$

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

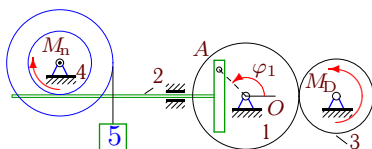
$$m_5 = 4 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

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

$$r_5 = 12 \text{ см}.$$

Задача D31.23.

3



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

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

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

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

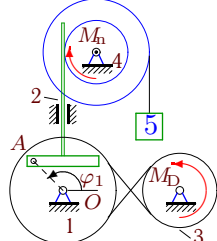
$$m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг}, m_4 = 27 \text{ кг},$$

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

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

Задача D31.24.

3



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

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

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

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

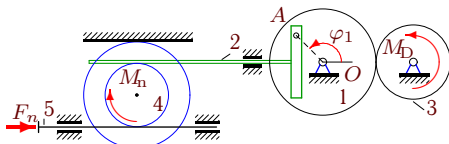
$$m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг}, m_4 = 28 \text{ кг},$$

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

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

Задача D31.25.

3



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

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

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

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

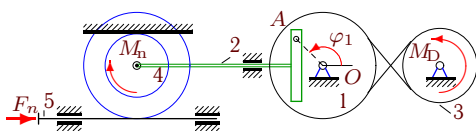
$$I_1 = 5 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

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

Задача D31.26.

3



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

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

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

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

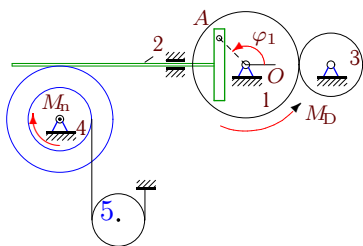
$$I_1 = 9 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

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

Задача D31.27.

3



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

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

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

$$\mu = 12 \text{ Нмс}, I_1 = 19 \text{ кгм}^2,$$

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

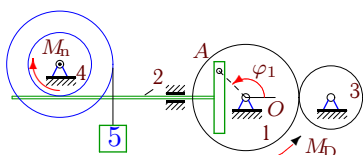
$$m_5 = 8 \text{ кг}, R_1 = 37 \text{ см}, r_1 = 26 \text{ см},$$

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

$$r_5 = 13 \text{ см}.$$

Задача D31.28.

3



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

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

$$\varphi_{1,0} = 1.2, \omega_{1z,0} = 0.5 \frac{1}{\text{с}},$$

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

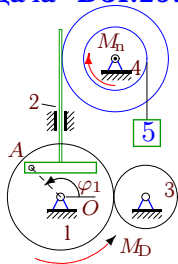
$$m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг}, m_4 = 25 \text{ кг},$$

$$m_5 = 5 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

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

Задача D31.29.

3



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

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

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

$$\mu = 15 \text{ Нмс}, \quad I_1 = 7 \text{ кгм}^2,$$

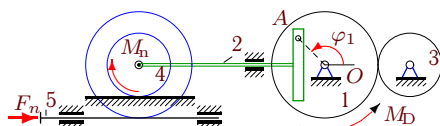
$$m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \quad m_4 = 24 \text{ кг},$$

$$m_5 = 5 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

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

Задача D31.30.

3



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

$$F_{nx} = -\nu v_{5x}, \quad \varphi_{1,0} = 1.4, \quad \omega_{1z,0} = 0.3 \frac{1}{\text{с}},$$

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

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

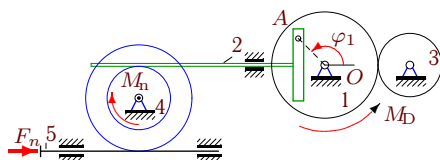
$$I_1 = 19 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг},$$

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

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

Задача D31.31.

3



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

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

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

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

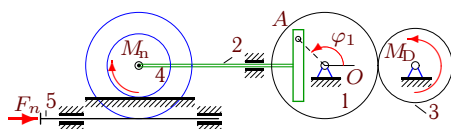
$$I_1 = 15 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

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

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

Задача D31.32.

3



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

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

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

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

$$I_1 = 7 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг},$$

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

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

	A	B	Q	ε	B_2	B_4	B_5	Q_F	Q_M	Q_D	Q_T
1	13.138	1.838	9.628	0.650	0.94	0.77	0.14	0.00	-5.70	7.10	8.23
2*	21.527	2.578	-1.389	-0.059	1.24	1.26	0.08	0.00	-0.32	5.50	-6.57
3	6.074	14.211	-60.915	-3.539	0.88	13.34	0.00	-11.17	-32.58	-17.17	0.00
4	10.333	6.387	-39.612	-2.376	1.13	5.26	0.00	-2.65	-14.25	-22.71	0.00
5	9.144	16.920	-42.127	-1.652	0.98	15.94	0.00	-4.20	-19.23	-18.70	0.00
6*	20.333	1.865	-30.431	-1.495	1.13	0.74	0.00	0.00	-0.01	-25.48	-4.94
7*	14.327	1.715	-43.405	-2.999	1.08	0.63	0.00	0.00	-0.25	-25.59	-17.57
8	25.464	6.908	-107.813	-3.336	1.22	5.69	0.00	-95.66	-20.55	8.40	0.00
9	9.138	3.585	-21.149	-1.735	0.94	2.13	0.52	0.00	-14.70	4.98	-11.43
10	15.599	2.686	-1.991	-0.112	1.31	1.37	0.00	-0.57	-3.90	2.47	0.00
11	17.527	21.414	-104.212	-2.743	1.24	20.18	0.00	-13.27	-60.84	-30.10	0.00
12	9.144	3.744	-28.804	-2.256	0.98	2.76	0.00	-0.78	-9.32	-18.70	0.00
13	5.960	2.773	-29.647	-3.638	0.81	1.97	0.00	-11.71	-3.43	-14.50	0.00
14	20.081	5.406	-25.028	-0.983	0.95	4.45	0.00	-0.75	-3.66	-20.62	0.00
15	20.464	14.023	-78.845	-2.295	1.22	12.81	0.00	-8.47	-42.04	-28.33	0.00
16	21.527	9.841	39.364	1.253	1.24	3.50	5.10	0.00	-27.04	5.50	60.90
17	5.850	12.028	-24.466	-1.592	0.74	11.29	0.00	-3.15	-9.19	-12.12	0.00
18	6.907	2.764	-15.446	-1.660	0.79	1.97	0.00	-0.41	-1.49	-13.54	0.00
19	10.965	1.728	10.589	0.842	0.85	0.88	0.00	-0.26	-1.11	11.96	0.00
20	14.083	1.507	-21.178	-1.369	0.92	0.59	0.00	-0.21	-0.87	-20.10	0.00
21	10.081	1.590	-19.804	-1.698	0.95	0.64	0.00	-1.68	-0.33	-17.79	0.00
22*	7.960	1.422	-31.863	-3.858	0.81	0.58	0.03	0.00	-0.89	-17.30	-13.67
23	9.527	5.548	-37.024	-2.498	1.24	3.50	0.81	0.00	-27.04	-27.39	17.40
24*	20.205	5.394	-23.999	-1.185	1.04	3.24	1.12	0.00	-0.04	-22.90	-1.05
25	7.259	16.752	-82.347	-3.817	1.01	15.74	0.00	-13.15	-47.71	-21.48	0.00
26	11.383	5.397	-63.852	-4.002	1.09	4.30	0.00	-7.88	-28.59	-27.39	0.00
27	21.396	2.390	-6.510	-0.277	1.15	1.17	0.07	0.00	-7.88	7.40	-6.03
28	13.383	4.587	-4.513	-0.282	1.09	2.48	1.01	0.00	-28.59	3.50	20.57
29*	9.310	1.891	-13.528	-1.375	1.02	0.74	0.13	0.00	-2.81	2.50	-13.22
30	21.268	5.750	-69.550	-2.593	1.06	4.69	0.00	-64.74	-13.91	9.10	0.00
31	17.203	3.539	-393.259	-19.198	1.00	2.54	0.00	-386.85	-14.51	8.10	0.00
32	9.396	6.219	-137.644	-8.928	1.15	5.07	0.00	-93.36	-20.06	-24.22	0.00