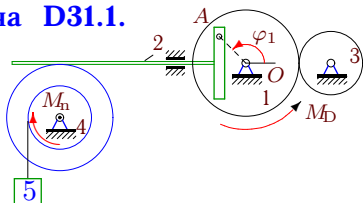


Кулиса. Уравнение Лагранжа

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.



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

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

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

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

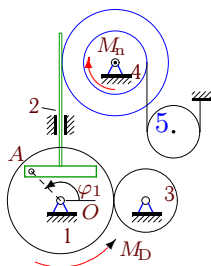
$$m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \quad m_4 = 25 \text{ кг},$$

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

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

3

Задача D31.2.



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

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

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

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

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

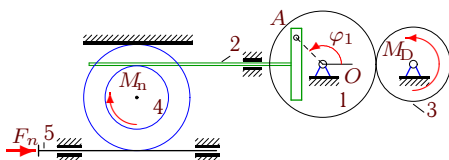
$$m_5 = 8 \text{ кг}, \quad R_1 = 38 \text{ см}, \quad r_1 = 27 \text{ см},$$

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

$$r_5 = 13 \text{ см}.$$

3

Задача D31.3.



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

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

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

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

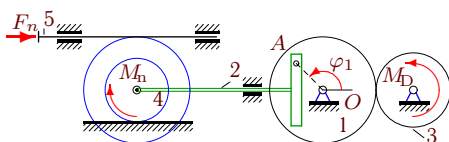
$$I_1 = 4 \text{ кгм}^2, \quad m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг},$$

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

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

3

Задача D31.4.



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

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

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

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

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

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

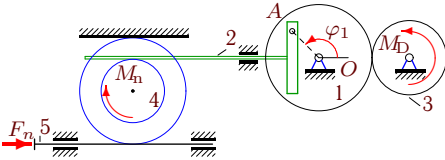
$$R_3 = 26 \text{ см}, \quad R_4 = 20 \text{ см}, \quad r_4 = 12 \text{ см}, \quad i_4 = 17 \text{ см}.$$

3

¹В некоторых вариантах содержатся не все элементы.

Задача D31.5.

3



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

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

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

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

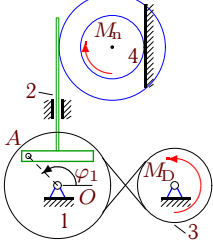
$$I_1 = 7 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг},$$

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

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

Задача D31.6.

3



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

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

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

$$\mu = 11 \text{ Нмс},$$

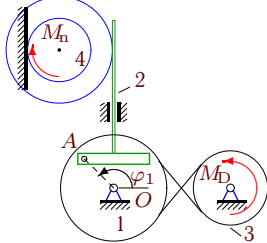
$$I_1 = 18 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

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

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

Задача D31.7.

3



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

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

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

$$\mu = 13 \text{ Нмс},$$

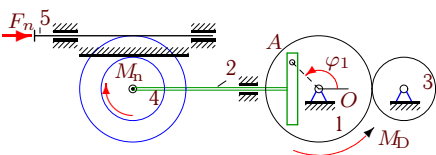
$$I_1 = 12 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

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

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

Задача D31.8.

3



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

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

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

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

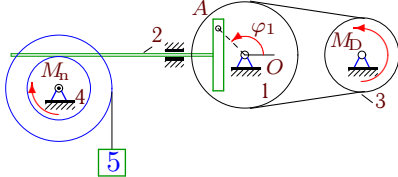
$$I_1 = 23 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

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

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

Задача D31.9.

3



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

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

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

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

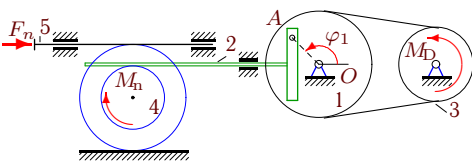
$$m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \quad m_4 = 25 \text{ кг},$$

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

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

Задача D31.10.

3



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

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

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

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

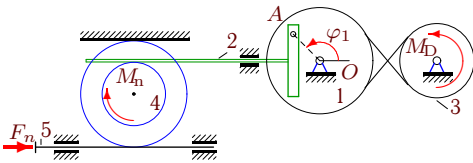
$$I_1 = 13 \text{ кгм}^2, \quad m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг},$$

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

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

Задача D31.11.

3



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

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

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

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

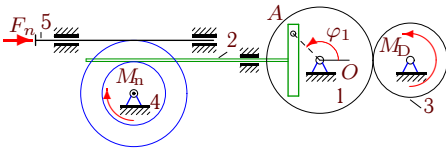
$$I_1 = 15 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.12.

3



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

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

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

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

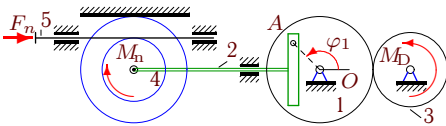
$$I_1 = 7 \text{ кгм}^2, m_2 = 17 \text{ кг}, m_3 = 35 \text{ кг},$$

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

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

Задача D31.13.

3



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

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

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

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

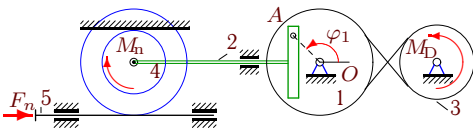
$$I_1 = 4 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

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

Задача D31.14.

3



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

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

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

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

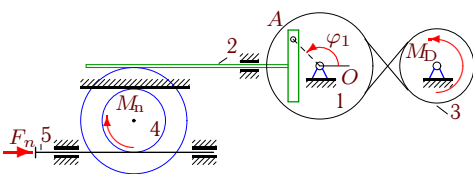
$$I_1 = 18 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.15.

3



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

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

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

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

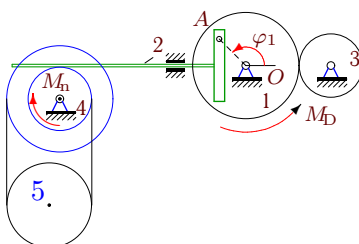
$$I_1 = 18 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.16.

3



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

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

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

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

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

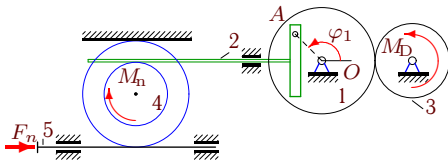
$$m_5 = 70 \text{ кг}, R_1 = 38 \text{ см}, r_1 = 27 \text{ см},$$

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

$$r_5 = 16 \text{ см}.$$

Задача D31.17.

3



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

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

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

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

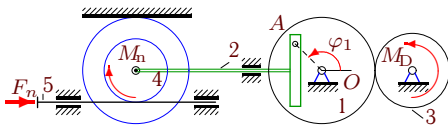
$$I_1 = 4 \text{ кгм}^2, m_2 = 14 \text{ кг}, m_3 = 32 \text{ кг},$$

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

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

Задача D31.18.

3



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

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

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

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

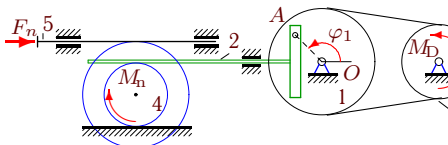
$$I_1 = 5 \text{ кгм}^2, m_2 = 15 \text{ кг}, m_3 = 33 \text{ кг},$$

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

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

Задача D31.19.

3



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

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

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

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

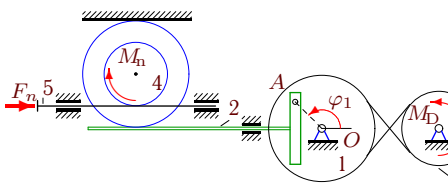
$$I_1 = 9 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

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

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

Задача D31.20.

3



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

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

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

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

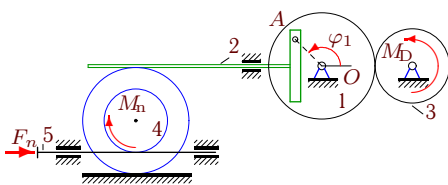
$$I_1 = 12 \text{ кгм}^2, m_2 = 16 \text{ кг}, m_3 = 34 \text{ кг},$$

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

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

Задача D31.21.

3



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

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

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

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

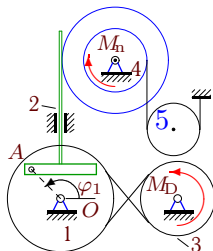
$$I_1 = 8 \text{ кгм}^2, m_2 = 18 \text{ кг}, m_3 = 36 \text{ кг},$$

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

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

Задача D31.22.

3



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

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

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

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

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

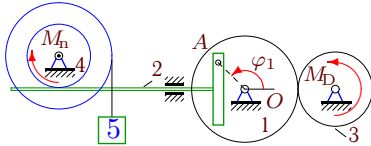
$$m_5 = 4 \text{ кг}, R_1 = 35 \text{ см}, r_1 = 24 \text{ см},$$

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

$$r_5 = 12 \text{ см}.$$

Задача D31.23.

3



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

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

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

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

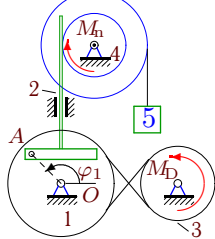
$$m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг}, \quad m_4 = 27 \text{ кг},$$

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

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

Задача D31.24.

3



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

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

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

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

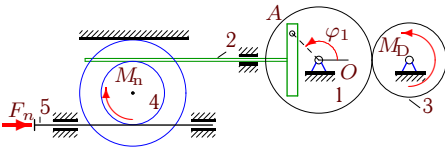
$$m_2 = 18 \text{ кг}, \quad m_3 = 36 \text{ кг}, \quad m_4 = 28 \text{ кг},$$

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

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

Задача D31.25.

3



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

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

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

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

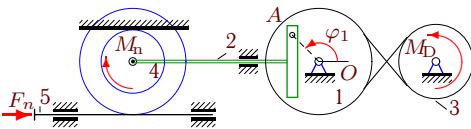
$$I_1 = 5 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг},$$

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

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

Задача D31.26.

3



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

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

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

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

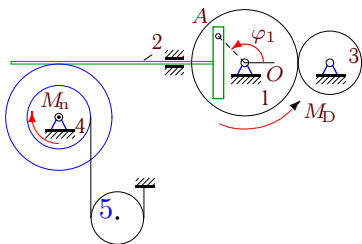
$$I_1 = 9 \text{ кгм}^2, \quad m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг},$$

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

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

Задача D31.27.

3



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

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

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

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

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

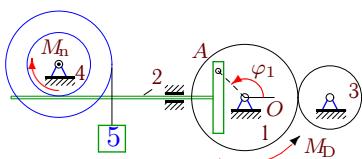
$$m_5 = 8 \text{ кг}, \quad R_1 = 37 \text{ см}, \quad r_1 = 26 \text{ см},$$

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

$$r_5 = 13 \text{ см}.$$

Задача D31.28.

3



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

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

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

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

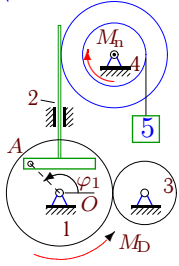
$$m_2 = 15 \text{ кг}, \quad m_3 = 33 \text{ кг}, \quad m_4 = 25 \text{ кг},$$

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

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

Задача D31.29.

3



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

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

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

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

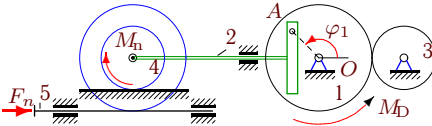
$$m_2 = 14 \text{ кг}, \quad m_3 = 32 \text{ кг}, \quad m_4 = 24 \text{ кг},$$

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

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

Задача D31.30.

3



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

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

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

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

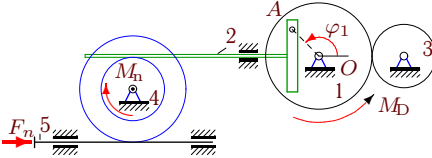
$$I_1 = 19 \text{ кгм}^2, \quad m_2 = 17 \text{ кг}, \quad m_3 = 35 \text{ кг},$$

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

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

Задача D31.31.

3



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

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

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

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

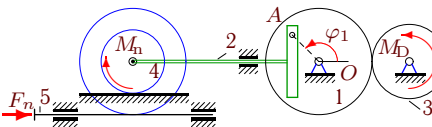
$$I_1 = 15 \text{ кгм}^2, \quad m_2 = 16 \text{ кг}, \quad m_3 = 34 \text{ кг},$$

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

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

Задача D31.32.

3



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

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

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

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

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

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

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

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 | 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 |

D31 файл о31d3A