

$$(14.28) \quad Ax^2 + Bxy + Cy^2 + 2x + py + r = 0$$

$$\Delta = 4AC - B^2 \neq 0, \quad (2B - 2pA) \geq (4rA - d^2)(4AC - B^2)$$

$$2A\delta x \cdot x + B_y \delta x + Bx \delta y + 2C_y \delta y + 2\delta x + p\delta y = 0$$

$$\delta y = - \frac{2Ax + B_y + d}{2C_y + Bx + p} \delta x$$

$$\text{Работа центростремительной} = -mg \delta y = mg \frac{2Ax + B_y + d}{2C_y + Bx + p} \delta x = 0$$

$$\Rightarrow 2Ax + B_y + d = 0 \Rightarrow y = - \frac{2Ax + d}{B}$$

$$Ax^2 + Bx \cdot \left(-\frac{1}{B}\right)(2Ax + d) + C \frac{1}{B^2} (2Ax + d)^2 + 2x + p\left(-\frac{1}{B}\right) \cdot$$

$$(2Ax + d) + r = Ax^2 - x(2Ax + d) + \frac{C}{B^2} (2Ax + d)^2 + 2x -$$

$$-\frac{p}{B} (2Ax + d) + r = 0$$



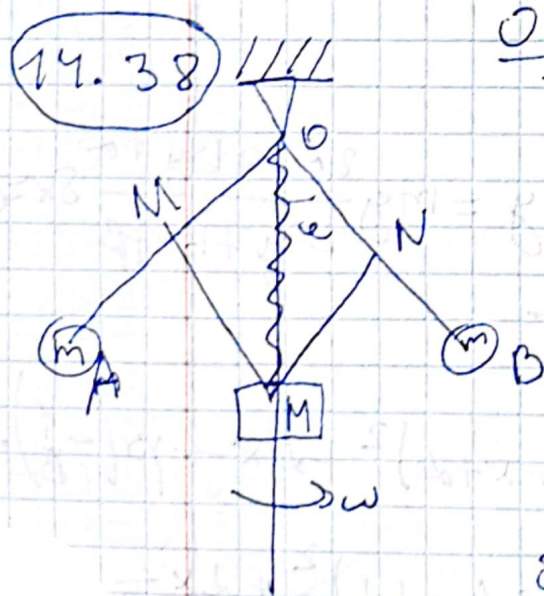
$$-Ax^2 + \frac{4A^2C}{B^2}x^2 + \frac{4AC}{B^2}dx + \frac{d^2C}{B^2} - \frac{2Ap}{B}x - \frac{dp}{B} + \gamma = 0$$

$$A(4AC - B^2)x^2 + 2A(2dC - pB)x + d^2C - 2pB + \gamma B^2 = 0$$

$$x = \frac{-A(2dC - pB)}{A(4AC - B^2)} \pm \frac{\sqrt{A^2(2dC - pB)^2 + A^2(B^2 - 4AC)(d^2C - 2pB + \gamma B^2)}}{A(4AC - B^2)}$$

$$= \frac{2dC - pB}{B^2 - 4AC} \pm \frac{\sqrt{(2dC - pB)^2 + (B^2 - 4AC)(d^2C - 2pB + \gamma B^2)}}{B^2 - 4AC}$$

$$y = -\frac{2Ax + d}{B}$$



$$\frac{OA}{2} = \frac{OB}{2} = OM = ON = CM = CN = l$$

$$OC = 2l \cos \theta$$

$$\vec{r}_A = (-2l \sin \theta, -2l \cos \theta)$$

$$\vec{r}_B = (2l \sin \theta, -2l \cos \theta)$$

$$\vec{r}_C = (0, -2l \cos \theta)$$

$$\delta \vec{r}_A = (-2l \cos \theta, 2l \sin \theta) \delta \theta$$

$$\delta \vec{r}_B = (2l \cos \theta, 2l \sin \theta) \delta \theta$$

$$\delta \vec{r}_C = (0, 2l \sin \theta) \delta \theta$$



Амплитуде колебаний

$$\vec{F}_{A4} = \begin{pmatrix} -m\omega^2 l \sin \varphi \\ 0 \end{pmatrix} \quad \vec{F}_{B4} = \begin{pmatrix} m\omega^2 l \sin \varphi \\ 0 \end{pmatrix}$$

$$\vec{F}_A = \vec{F}_B = \begin{pmatrix} 0 \\ -mg \end{pmatrix} \quad \vec{F}_C = \begin{pmatrix} 0 \\ -Mg - k\Delta \end{pmatrix}$$

$$\Delta = 2l - 2l \cos \varphi$$

Работа амплитуде колебаний на вынужденных резонансах

$$(\vec{F}_{A4} + \vec{F}_A) \delta \vec{r}_A + (\vec{F}_{B4} + \vec{F}_B) \delta \vec{r}_B + \vec{F}_C \delta \vec{r}_C =$$

$$= (2m\omega^2 l \sin \varphi - 2mg) \cdot 2l \cos \varphi - 2 \cdot 2l \sin \varphi mg - (Mg + k\Delta) 2l \sin \varphi.$$

$$\cdot \delta \varphi = (8m\omega^2 l^2 \sin \varphi \cos \varphi - 4lmg \sin \varphi - (Mg + 2k\Delta) 2l \sin \varphi) \cdot$$

$$\cdot \delta \varphi = 0$$

$$(4m\omega^2 l \cos \varphi - 2mg - Mg - 2lk(1 - \cos \varphi)) \sin \varphi = 0$$

$$1) \varphi_1 = 0, \varphi_2 = \pi$$

$$2) \varphi \neq 0 \text{ или } \pi$$

$$(4m\omega^2 l + 2lk) \cos \varphi = 2mg + Mg + 2lk$$

$$\cos \varphi = \frac{2mg + Mg + 2lk}{l(4m\omega^2 l + 2lk)}$$

14.41

$$\begin{cases} -2x + y + z - t = 0 \\ x - 2y + z + t^2 = 0 \end{cases}$$

Виртуальные перемещения

$$\begin{cases} -2\delta x + \delta y + \delta z = 0 \\ \delta x - 2\delta y + \delta z = 0 \end{cases}$$

$$\Rightarrow \delta x = \delta y = \delta z \Rightarrow \delta \vec{r} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \delta \lambda$$

Возможные перемещения

$$\begin{cases} -2\dot{x} + \dot{y} + \dot{z} - 1 = 0 \\ \dot{x} - 2\dot{y} + \dot{z} + 2t = 0 \end{cases} \Rightarrow 3\dot{x} - 3\dot{y} + (2t+1) = 0$$

$$\begin{aligned} \dot{y} &= \frac{2t+1}{3} + \dot{x} \Rightarrow \dot{z} = 1 + 2\dot{x} - \dot{y} = 1 + 2\dot{x} - \dot{x} - \frac{2t+1}{3} = \\ &= \dot{x} + \frac{2-2t}{3} \end{aligned}$$

$$\dot{\vec{r}} = \begin{pmatrix} \dot{x} \\ \dot{x} + \frac{2t+1}{3} \\ \dot{x} + \frac{2-2t}{3} \end{pmatrix} \Rightarrow d\vec{r} = \left( \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \dot{x} + \frac{1}{3} \begin{pmatrix} 0 \\ 2t+1 \\ 2-2t \end{pmatrix} \right) dt$$

$\dot{x}$  - бесконечно малая скорость