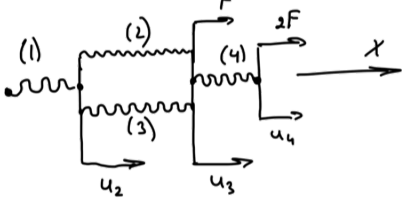
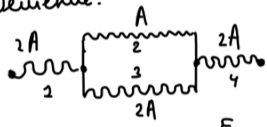


Вычислительная механика. УЧ-52
Фабриков Д.
Домашнее задание №1.
Вариант 2.

1) Дано: $L_1 = L$; $L_2 = 2L$; $L_3 = L$
 $A_1 = 2A$; $A_2 = 2A$; $A_3 = A$; $A_4 = 2A$
 $F_1 = 0$; $F_2 = F$; $F_3 = 2F$

Решение:



$$\{a\} = \begin{Bmatrix} u_2 \\ u_3 \\ u_4 \\ u_5 \end{Bmatrix} \quad \{F\} = \begin{Bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \end{Bmatrix} = \begin{Bmatrix} 0 \\ F \\ 2F \\ 0 \end{Bmatrix}$$

$$[K^{(1)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \end{matrix}$$

$$[K^{(2)}] = \frac{EA}{2L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 1/2 & -1/2 \\ -1/2 & 1/2 \end{bmatrix} \begin{matrix} u_3 \\ u_4 \end{matrix}$$

$$[K^{(3)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_4 \\ u_5 \end{matrix}$$

$$[K^{(4)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_5 \\ u_6 \end{matrix}$$

N	1A	2A
1	0	u_2
2	u_2	u_3
3	u_2	u_3
4	u_3	u_4

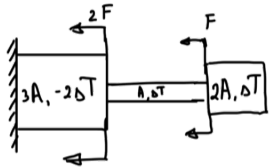
$$[K] = \frac{EA}{L} \begin{bmatrix} 3.5 & -1.5 & 0 \\ -1.5 & 3.5 & -2 \\ 0 & -2 & 2 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \\ u_4 \end{matrix}$$

$$[K]\{a\} = \{F\}$$

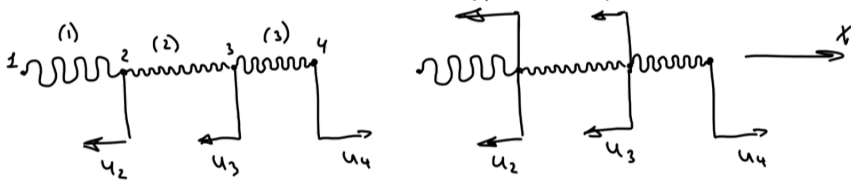
$$u_2, u_3, u_4 = \dots$$

2) Дано:

$L_1 = L$; $L_2 = 2L$; $L_3 = L$; $T_1 = -2\delta T$
 $A_1 = 3A$; $A_2 = A$; $A_3 = 2A$; $T_2 = \delta T$
 $F_1 = -2F$; $T_3 = \delta T$
 $F_2 = -F$

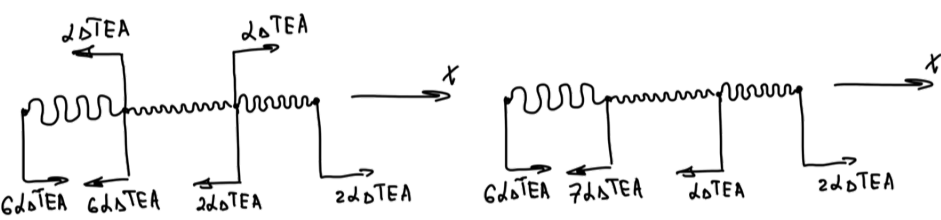
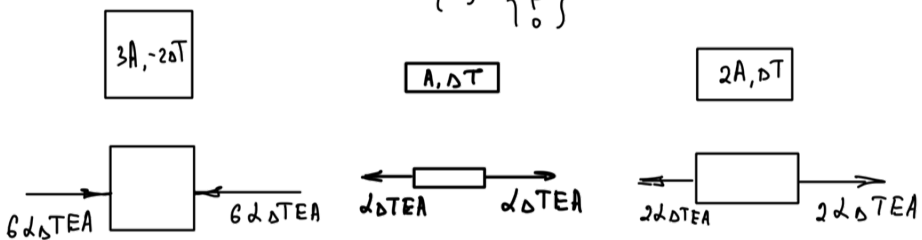


Решение:



$$\{a\} = \begin{Bmatrix} u_2 \\ u_3 \\ u_4 \end{Bmatrix}$$

$$\{F\} = \begin{Bmatrix} -2F \\ -F \\ 0 \end{Bmatrix}$$



$$\{F_{\text{гон}}\} = \begin{Bmatrix} -7\delta T EA \\ -\delta T EA \\ 2\delta T EA \end{Bmatrix}$$

$$[K^{(1)}] = \frac{3EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 3 & -3 \\ -3 & 3 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \end{matrix}$$

$$[K^{(2)}] = \frac{EA}{2L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 1/2 & -1/2 \\ -1/2 & 1/2 \end{bmatrix} \begin{matrix} u_3 \\ u_4 \end{matrix}$$

$$[K^{(3)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_4 \\ u_5 \end{matrix}$$

$$[K] = \frac{EA}{L} \begin{bmatrix} 3.5 & -1.5 & 0 \\ -1.5 & 2.5 & -2 \\ 0 & -2 & 2 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \\ u_4 \end{matrix}$$

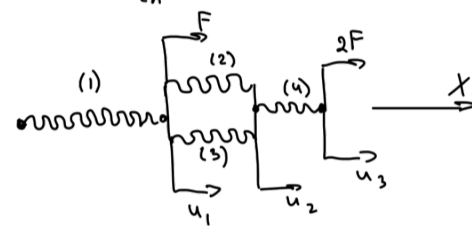
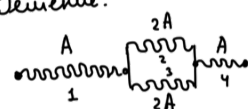
$$[K]\{a\} = \{F\} + \{F_{\text{гон}}\}$$

$$u_2, u_3, u_4 = \dots$$

2) Дано: УЧ-51:

1) Дано: $L_1 = 2L$; $L_2 = L$; $L_3 = L$
 $A_1 = A$; $A_2 = 2A$; $A_3 = 2A$; $A_4 = A$
 $F_1 = F$; $F_2 = 0$; $F_3 = 2F$

Решение:



$$\{a\} = \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix} \quad \{F\} = \begin{Bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \end{Bmatrix} = \begin{Bmatrix} F \\ 0 \\ 2F \\ 0 \end{Bmatrix}$$

$$[K^{(1)}] = \frac{EA}{2L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 1/2 & -1/2 \\ -1/2 & 1/2 \end{bmatrix} \begin{matrix} u_1 \\ u_2 \end{matrix}$$

$$[K^{(2)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \end{matrix}$$

$$[K^{(3)}] = \frac{2EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = \frac{EA}{L} \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix} \begin{matrix} u_3 \\ u_4 \end{matrix}$$

$$[K^{(4)}] = \frac{EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{matrix} u_4 \\ u_5 \end{matrix}$$

N	1A	2A
1	0	u_1
2	u_1	u_2
3	u_1	u_2
4	u_2	u_3

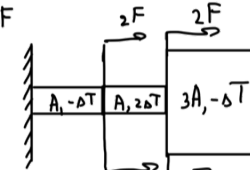
$$[K] = \frac{EA}{L} \begin{bmatrix} 4.5 & -4 & 0 \\ -4 & 5 & -1 \\ 0 & -1 & 1 \end{bmatrix} \begin{matrix} u_1 \\ u_2 \\ u_3 \end{matrix}$$

$$[K]\{a\} = \{F\}$$

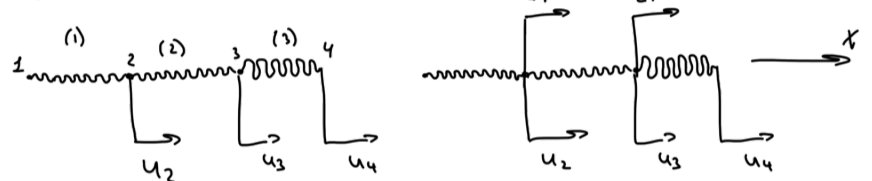
$$u_1, u_2, u_3 = \dots$$

2) Дано:

$L_1 = L$; $L_2 = L$; $L_3 = L$; $T_1 = -\delta T$
 $A_1 = A$; $A_2 = A$; $A_3 = 3A$; $T_2 = 2\delta T$
 $F_1 = 2F$; $T_3 = -\delta T$
 $F_2 = 2F$

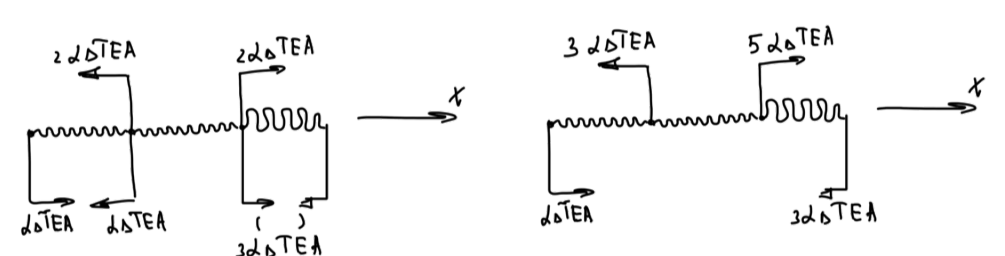
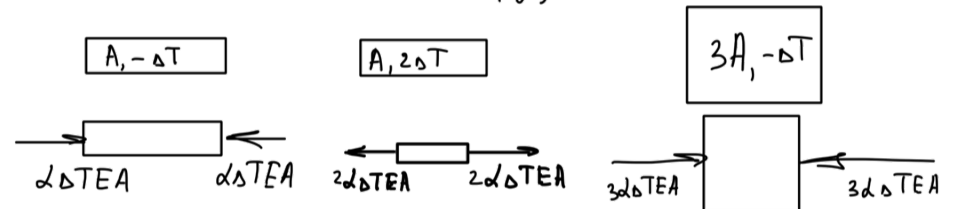


Решение:



$$\{a\} = \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \end{Bmatrix}$$

$$\{F\} = \begin{Bmatrix} 2F \\ 2F \\ 0 \end{Bmatrix}$$



$$\{F_{\text{гон}}\} = \begin{Bmatrix} -3\delta T EA \\ 5\delta T EA \\ -3\delta T EA \end{Bmatrix}$$

$$[K^{(1)}] = \frac{EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{matrix} u_1 \\ u_2 \end{matrix}$$

$$[K^{(2)}] = \frac{EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{matrix} u_2 \\ u_3 \end{matrix}$$

$$[K^{(3)}] = \frac{3EA}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{matrix} u_3 \\ u_4 \end{matrix}$$

$$[K] = \frac{EA}{L} \begin{bmatrix} 2 & -1 & 0 \\ -1 & 4 & -3 \\ 0 & -3 & 3 \end{bmatrix} \begin{matrix} u_1 \\ u_2 \\ u_3 \end{matrix}$$

$$[K]\{a\} = \{F\} + \{F_{\text{гон}}\}$$

$$u_1, u_2, u_3 = \dots$$