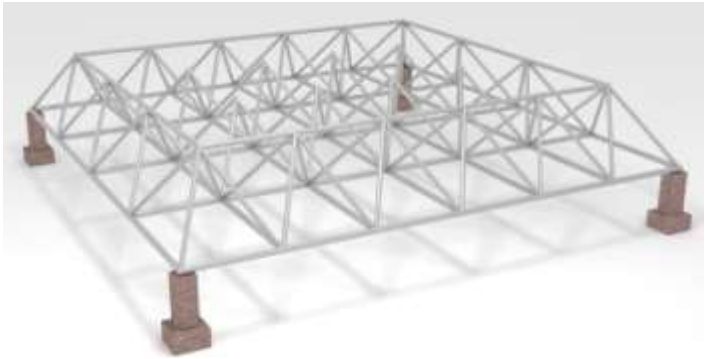
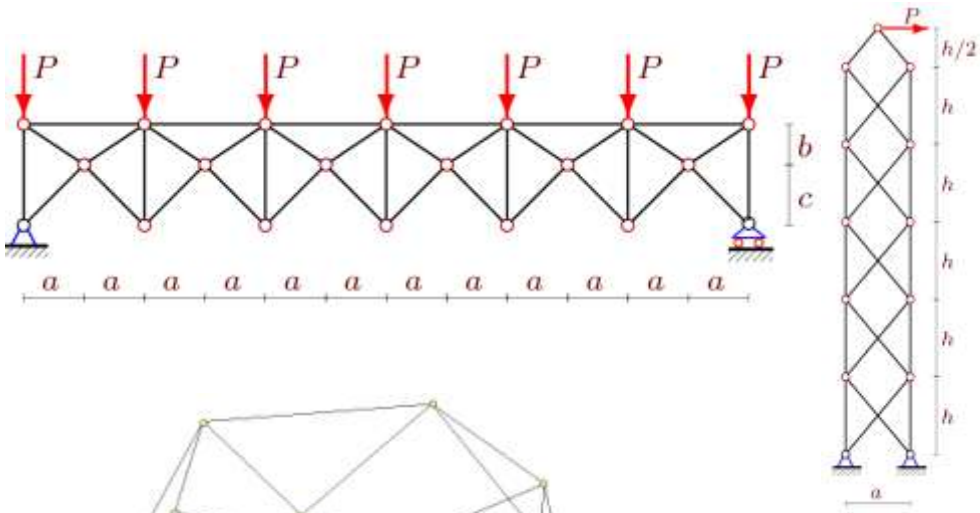
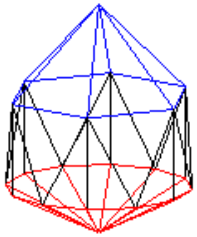
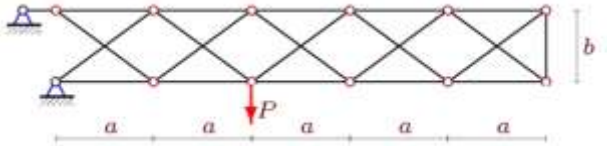
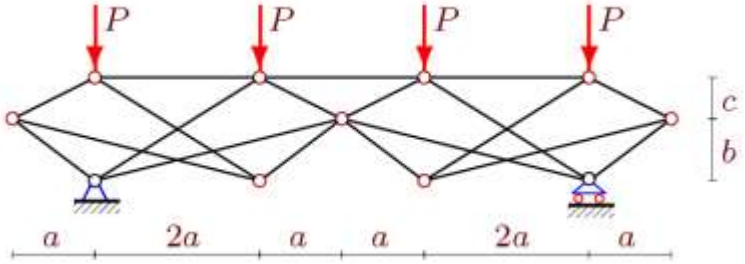
Индуктивный метод и проблема потери точности решения задачи о напряженном состоянии и деформации сложных конструкций

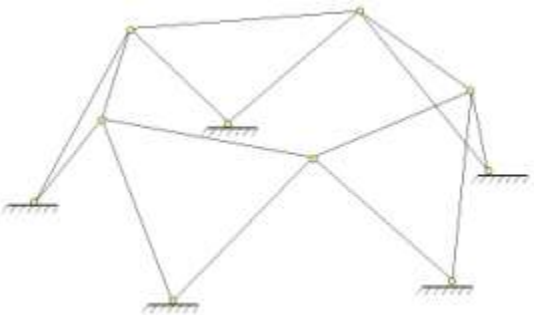




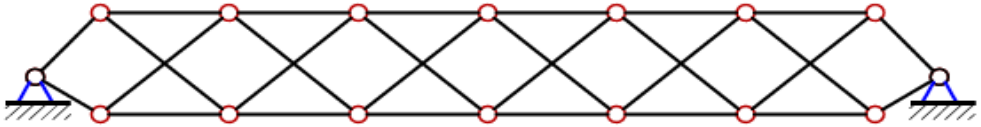


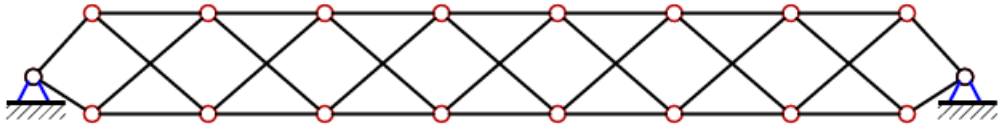


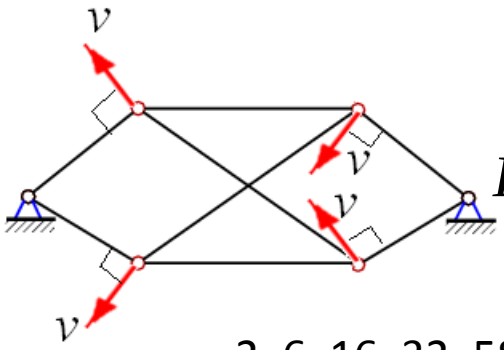




Пример 1







$$EF\Delta = P\sum_{i=1}^{m-4} S_i^2 l_i \qquad \tilde{\Delta}_k = (A_k(a^2+h^2)^{3/2} + B_k a^3)/h^2$$

2, 6, 16, 32, 58, 94, 144, 208, 290, 390

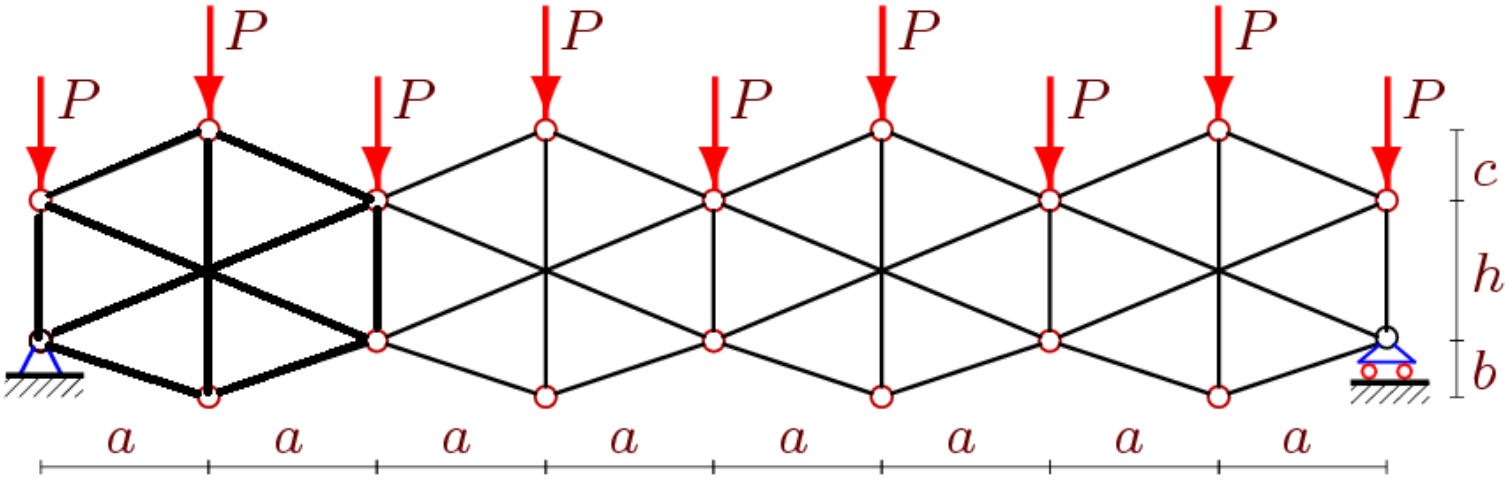
rgf_findrecur

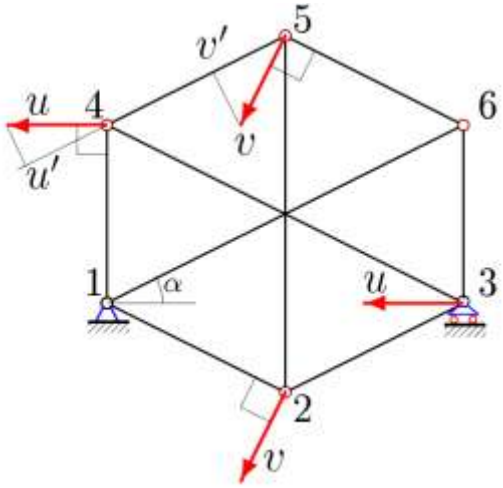
$$B_k = 3B_{k-1} - 2B_{k-2} - 2B_{k-3} + 3B_{k-4} - B_{k-5}$$

rsolve

$$B_k = (2k(4+3k+2k^2) + 3 - 3(-1)^k)/12$$

Пример 2





$$\Delta = \sum_{k=1}^{n_s-3} \frac{S_k s_k l_k}{EF_k}$$

Пример 2

$$\Delta EF = P(\gamma_1\Delta_1 + \gamma_2\Delta_2 + \gamma_3\Delta_3)/(b-c)^2,$$

$$\Delta_1 = 2C_1c^2g^3/h^2,$$

$$\Delta_2 = 2b(C_2b + C_3c)d^3/h^2,$$

$$\Delta_3 = (C_4d^3c^2 + C_5d^3cb + C_6d^3b^2 + C_7c^3b^2 + C_1b^3c^2 + C_8c^4b + C_9c^5)c^2.$$

$$C_1 = 2k^2(10k^2 - 7)/3, \qquad C_2 = 4k^2(5k^2 - 2)/3,$$

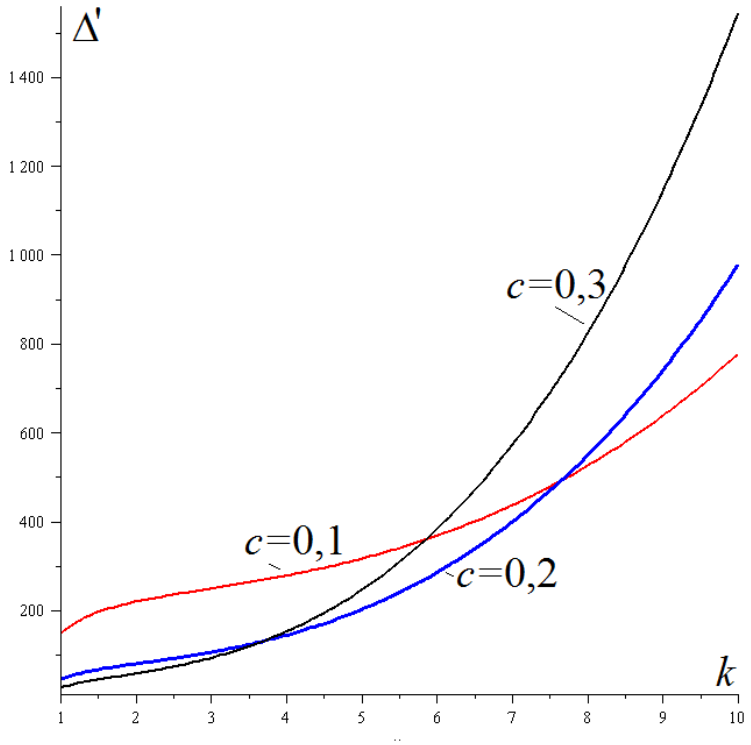
$$C_3 = -2k^2, \qquad C_4 = C_2/4,$$

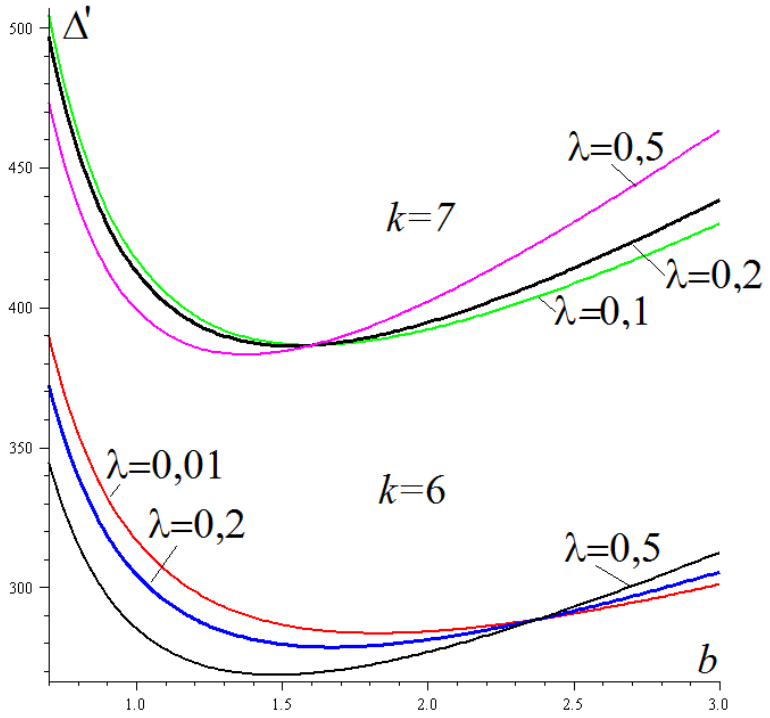
$$C_5 = k^2(10k^2 - 13)/3, \qquad C_6 = k^2(5k^2 + 1)/3,$$

$$C_7 = 50k^2(k^2 - 1) + 8(2k + 1), C_8 = 4(5k^4 - 7k^2 + 1),$$

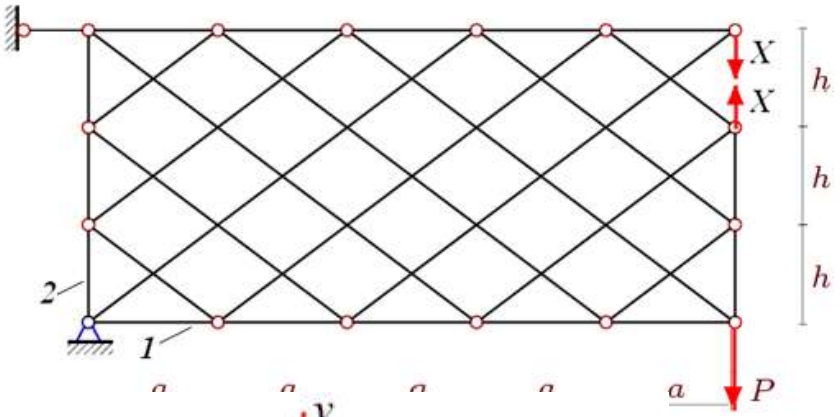
$$C_9 = 2k^2(5k^2 - 8)/3.$$

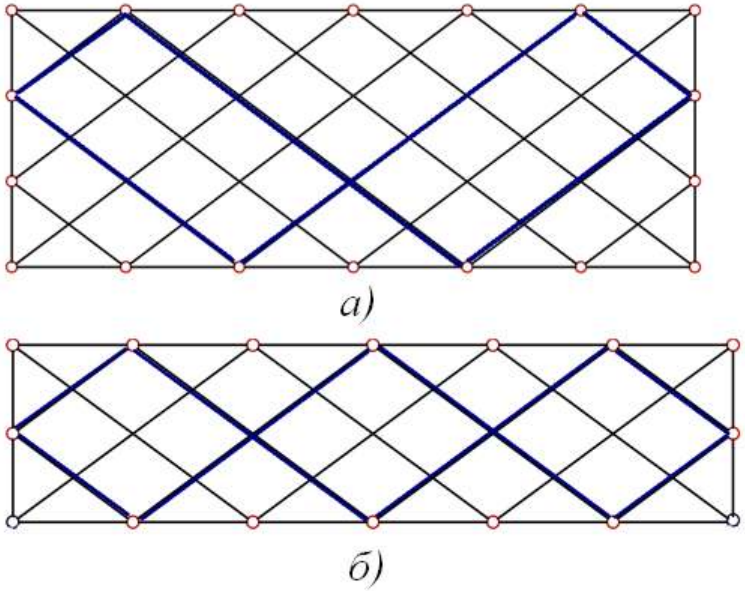
Пример 2

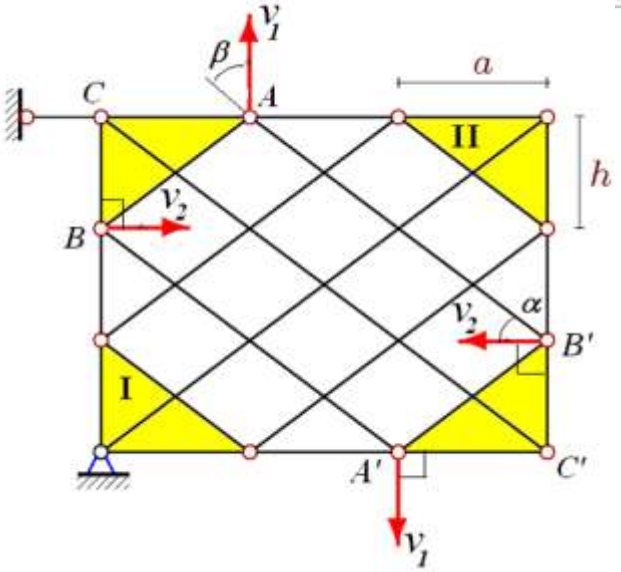

Δ'
1 400
1 200
1 000
800
600
400
200
c=0,3
c=0,1
c=0,2
k
1
2
3
4
5
6
7
8
9
10


Δ'
500
450
400
350
300
λ=0,5
k=7
λ=0,2
λ=0,1
λ=0,01
k=6
λ=0,2
λ=0,5
b
1.0
1.5
2.0
2.5
3.0

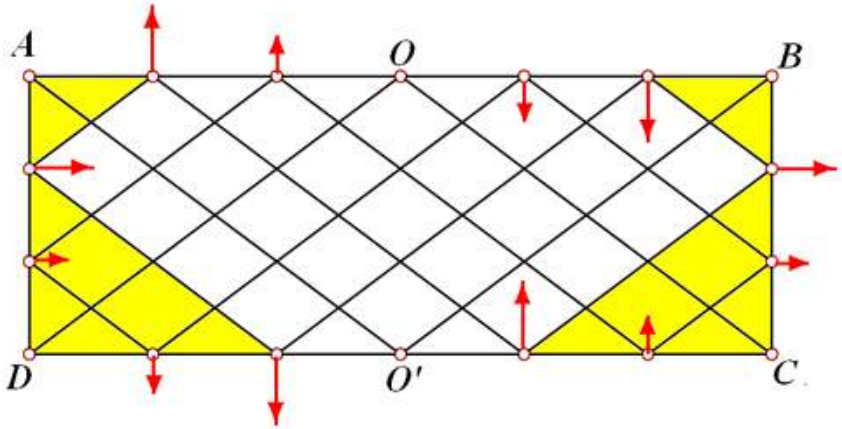
Пример 3



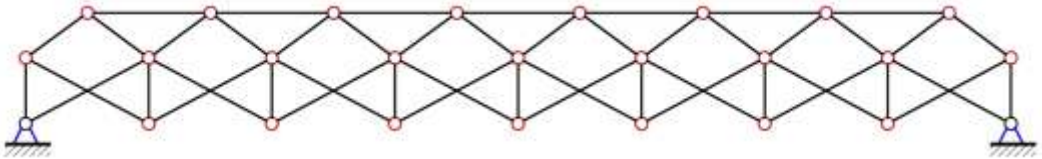


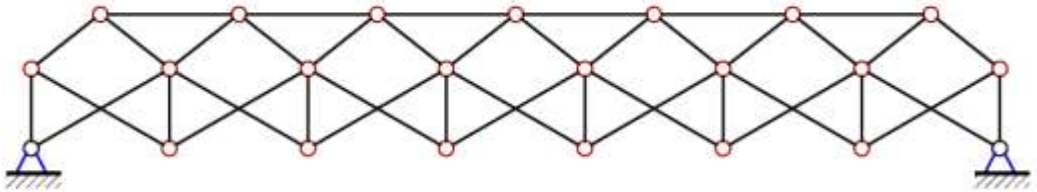


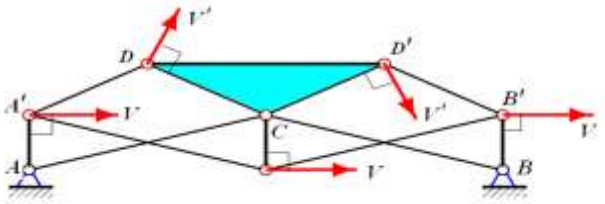
Рабинович И.М. Курс строительной механики стержневых систем. М.: Оникс, 2012. – 377 с.

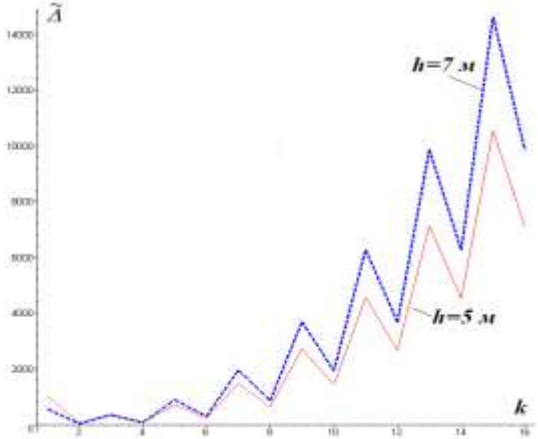


Пример 4









$$\Delta EF = P\frac{A_k a^3 + C_k c^3 + \psi_k h^3}{6h^2}$$

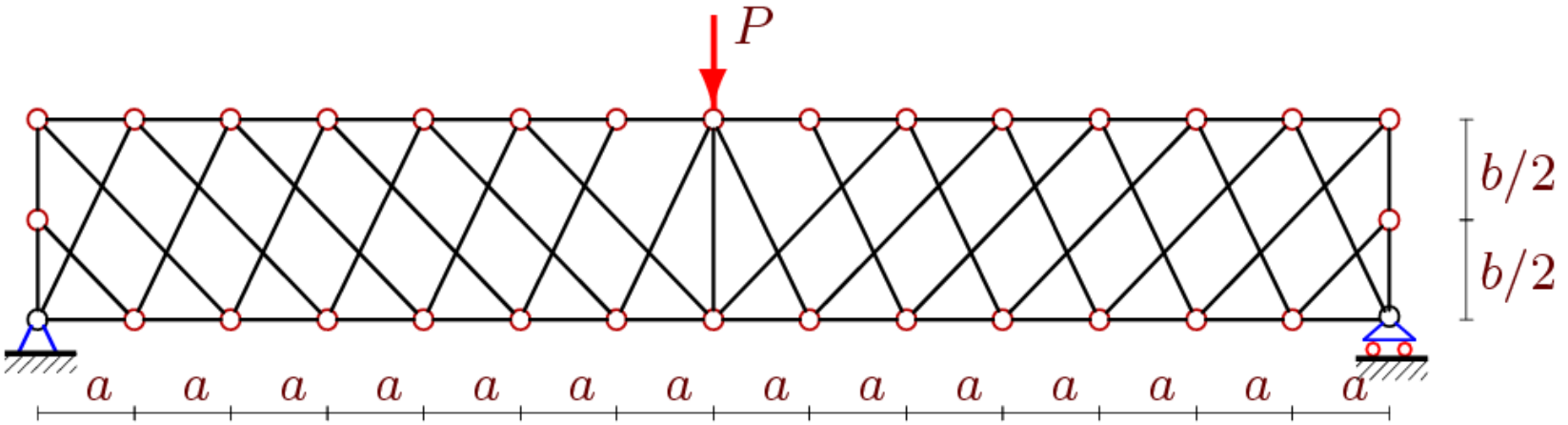
$$A_k = 2k^3 - 3k^2(1+(-1)^k) + k(1+3(-1)^k),$$

$$C_k = k^3 - (3/2)k^2(1+3(-1)^k) + (1/2)k(25+9(-1)^k) - 6 - 3(-1)^k,$$

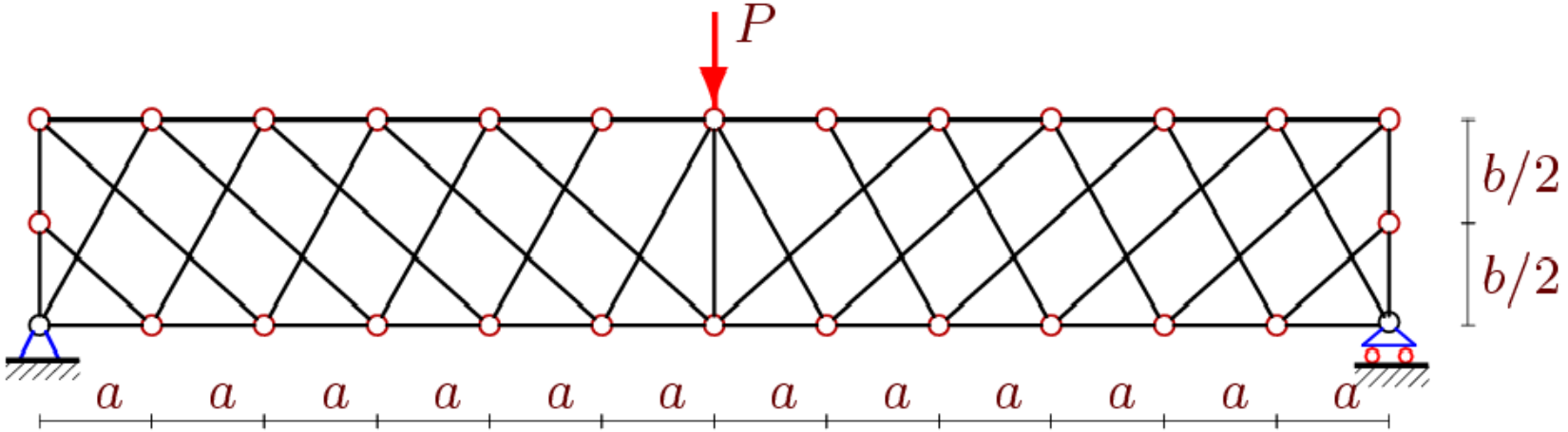
$$\Psi_k = 2k^3 - 3k^2(1+3(-1)^k) + k(19+9(-1)^k) - 9 - 15(-1)^k,$$

Пример 5

n=7

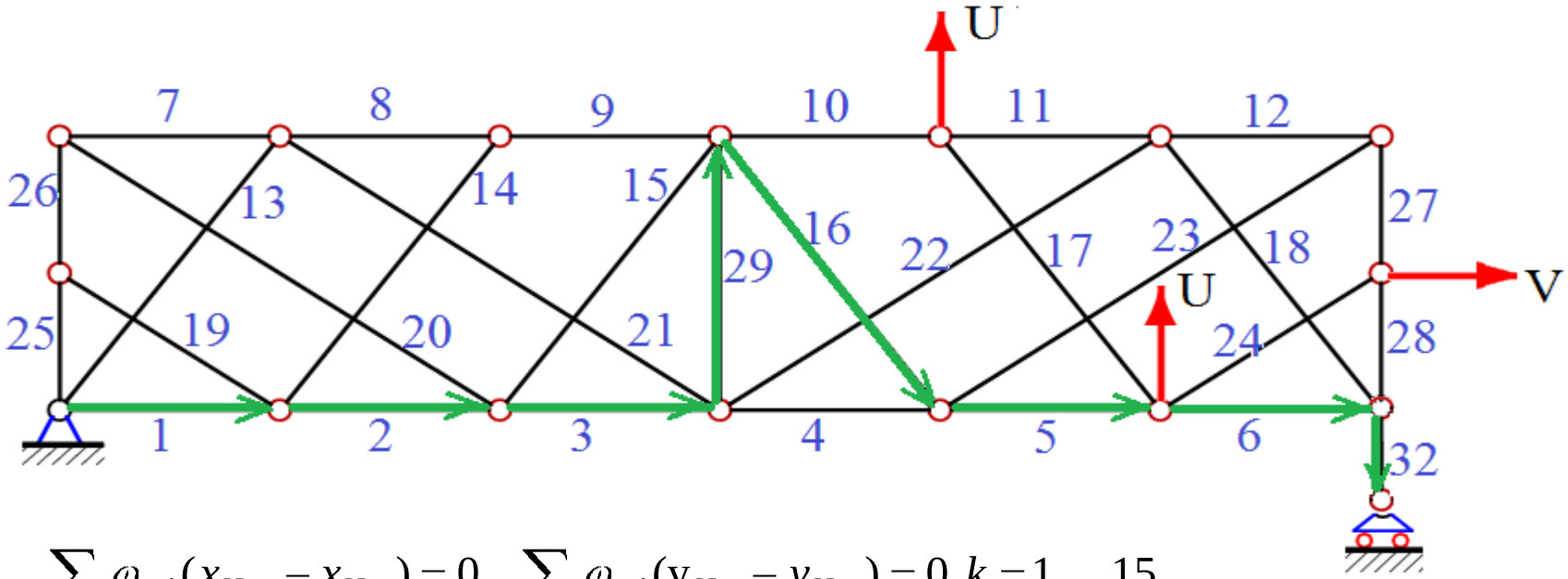


n=6



Пример 5

Схема возможных скоростей. Кинематический граф



$$\sum_{i\in Q_k} \omega_{z,i}(x_{N_{i,2}} - x_{N_{i,1}}) = 0, \quad \sum_{i\in Q_k} \omega_{z,i}(y_{N_{i,2}} - y_{N_{i,1}}) = 0, k = 1,\ldots,15$$

$$\omega_{z,5} = 1,\ \omega_{z,6} = -1,\ \omega_{z,10} = 1,$$

$$\omega_{z,11} = -1,\ \omega_{z,27} = 1,\ \omega_{z,28} = -1,$$

$$Q_1 = \{1,2,3,29,16,5,6,32\},$$

$$Q_2 = \{25,26,7,8,9,10,11,12,27,28,32\}$$

...

$$Q_{15} = \{25,19,2,3,4,5,6,32\}$$