# Условие равновесия механизма

Плоский многозвенный механизм с одной степенью свободы находится в равновесии. К кривошипу $OA$ приложен момент $M$. Размеры даны в сантиметрах. Дан ряд $p$ распределения дискретной случайной величины силы сопротивления в ползунах $T_i, i = 1, ..., 4$. Найти математическое ожидание и дисперсию момента $M$.

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**Задача L-27.1.** 1
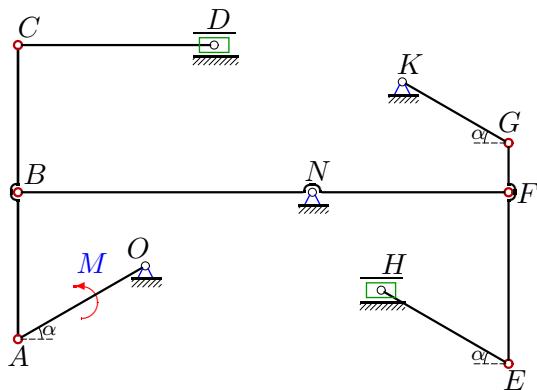


$\alpha = 30°$,
$AB = 30$, $BC = 30$,
$NB = 60$, $NF = 40$,
$CD = 40$, $EH = 30$,
$FE = 35$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ Н.
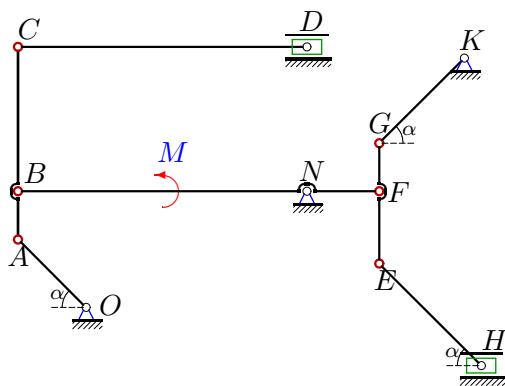
**Задача L-27.2.** 1



$\alpha = 45°$,
$AB = 10$, $BC = 30$,
$NB = 60$, $NF = 15$,
$CD = 60$, $EH = 30$,
$FE = 15$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5]$ Н.
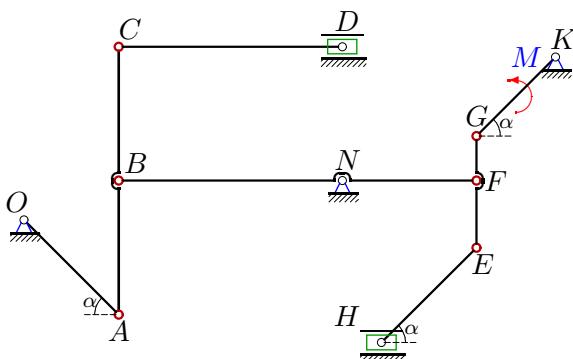
**Задача L-27.3.** 1



$\alpha = 45°$,
$AB = 30$, $BC = 30$,
$NB = 50$, $NF = 30$,
$CD = 50$, $EH = 30$,
$FE = 15$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7.5, 6.5, 5]$ Н.
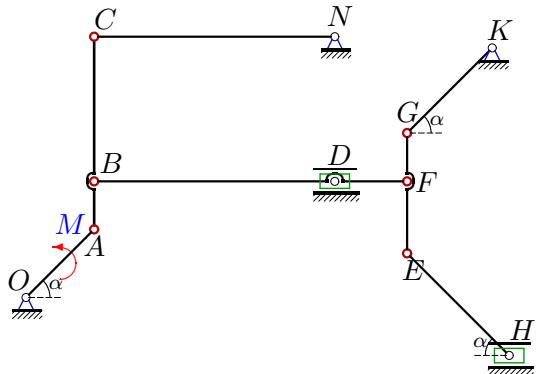
## Задача L-27.4.



$\alpha = 45°$,
$AB = 10$, $BC = 30$,
$DB = 50$, $DF = 15$,
$NC = 50$, $EH = 30$,
$FE = 15$, $FG = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5.5]$ H.

## Задача L-27.5.
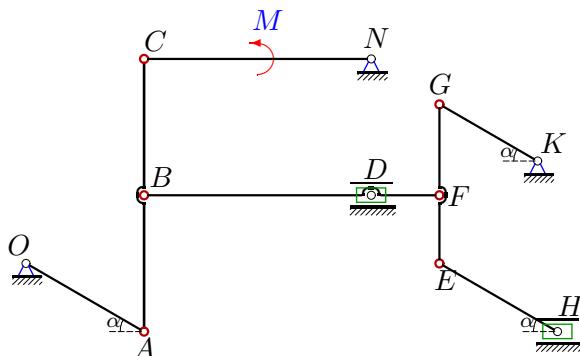


$\alpha = 30°$,
$AB = 30$, $BC = 30$,
$DB = 50$, $DF = 15$,
$NC = 50$, $EH = 30$,
$FE = 15$, $FG = 20$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5]$ H.

## Задача L-27.6.
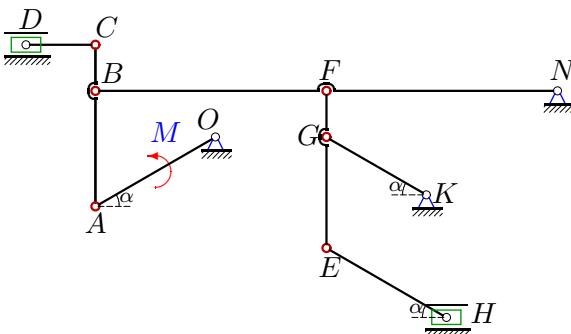


$\alpha = 30°$,
$AB = 25$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 15$, $EH = 30$,
$FG = 10$, $GE = 24$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5]$ H.

## Задача L-27.7.
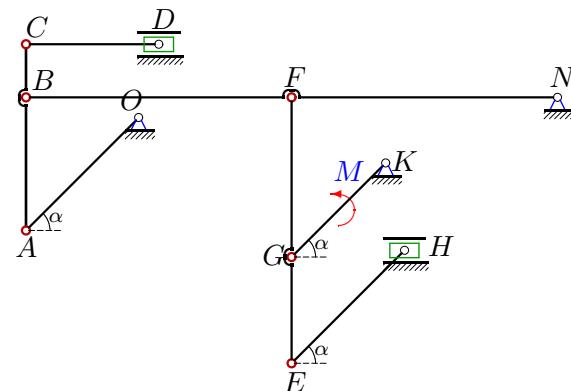


$\alpha = 45°$,
$AB = 25$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 25$, $EH = 30$,
$FG = 30$, $GE = 20$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5.5]$ H.

## Задача L-27.8.
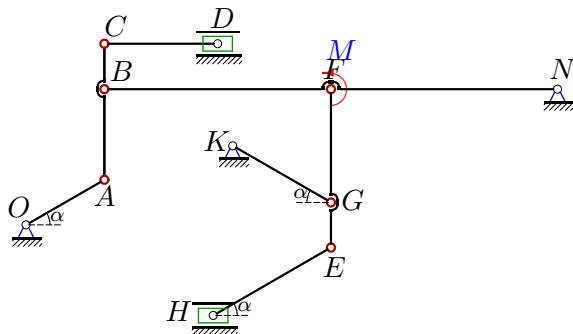


$\alpha = 30°$,
$AB = 20, BC = 10,$
$BF = 50, NF = 50,$
$CD = 25, EH = 30,$
$FG = 25, GE = 10,$
$OA = 20, KG = 25.$
$p = [0.05, 0.35, 0.35, 0.25],$
$T = [8.5, 7, 6, 5.5]$ Н.
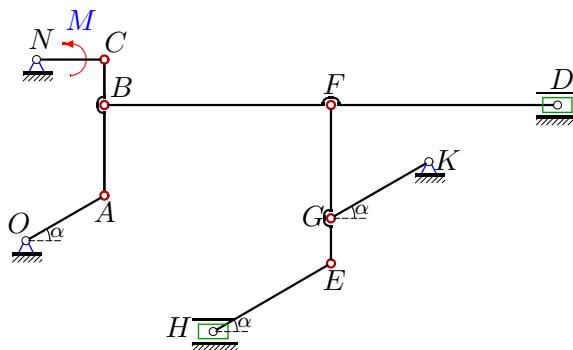
## Задача L-27.9.



$\alpha = 30°$,
$AB = 20, BC = 10,$
$BF = 50, FD = 50,$
$NC = 15, EH = 30,$
$FE = 35, FG = 25,$
$OA = 20, KG = 25.$
$p = [0.05, 0.35, 0.4, 0.2],$
$T = [8, 7, 6.5, 5]$ Н.
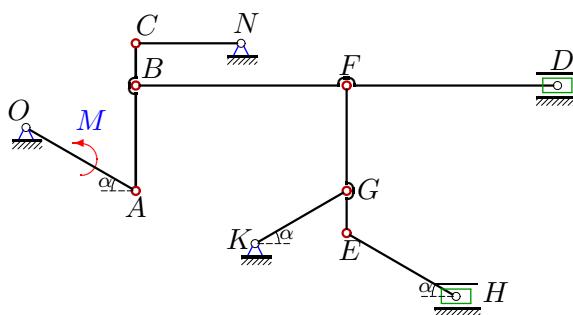
## Задача L-27.10.



$\alpha = 30°$,
$AB = 25, BC = 10,$
$BF = 50, FD = 50,$
$NC = 25, EH = 30,$
$FE = 35, FG = 25,$
$OA = 30, KG = 25.$
$p = [0.05, 0.35, 0.35, 0.25],$
$T = [8.5, 7, 6.5, 5]$ Н.
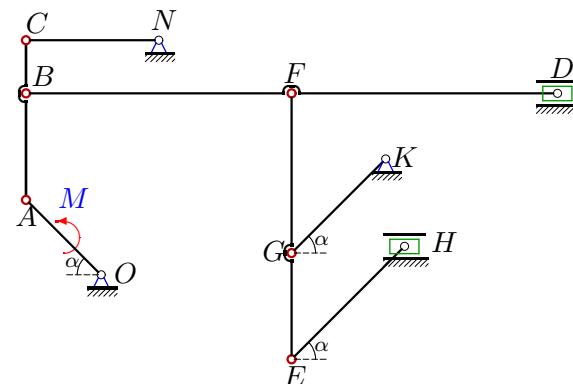
## Задача L-27.11.



$\alpha = 45°$,
$AB = 20, BC = 10,$
$BF = 50, FD = 50,$
$NC = 25, EH = 30,$
$FE = 50, FG = 30,$
$OA = 20, KG = 25.$
$p = [0.1, 0.3, 0.35, 0.25],$
$T = [8.5, 7, 6, 5.5]$ Н.
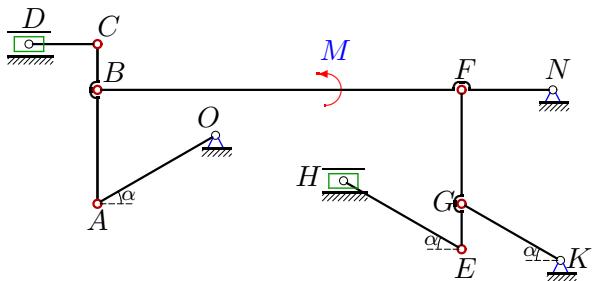
## Задача L-27.12.



$\alpha = 30°$,
$AB = 25,\ BC = 10,$
$BF = 80,\ NF = 20,$
$CD = 15,\ EH = 30,$
$FG = 25,\ GE = 10,$
$OA = 30,\ KG = 25.$
$p = [0.1, 0.3, 0.4, 0.2],$
$T = [8, 7.5, 6.5, 5.5]$ Н.
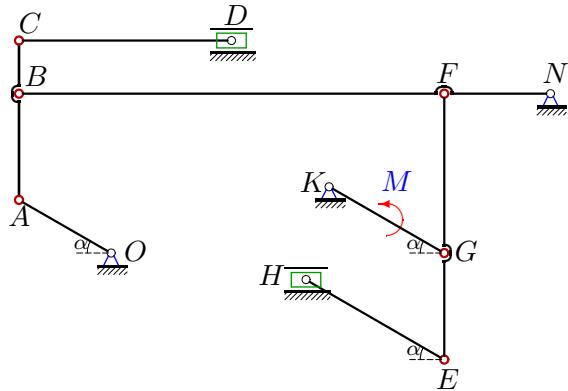
## Задача L-27.13.



$\alpha = 30°$,
$AB = 20,\ BC = 10,$
$BF = 80,\ NF = 20,$
$CD = 40,\ EH = 30,$
$FG = 30,\ GE = 20,$
$OA = 20,\ KG = 25.$
$p = [0.05, 0.35, 0.35, 0.25],$
$T = [8.5, 7, 6, 5.5]$ Н.
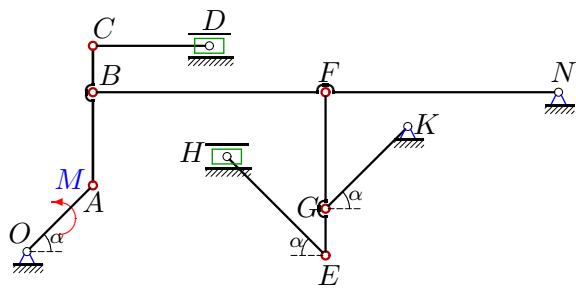
## Задача L-27.14.



$\alpha = 45°$,
$AB = 20,\ BC = 10,$
$BF = 50,\ NF = 50,$
$CD = 25,\ EH = 30,$
$FG = 25,\ GE = 10,$
$OA = 20,\ KG = 25.$
$p = [0.05, 0.35, 0.4, 0.2],$
$T = [8, 7, 6.5, 5.5]$ Н.

## Задача L-27.15.



$\alpha = 30°$,
$AB = 20,\ BC = 10,$
$BF = 50,\ FD = 50,$
$NC = 15,\ EH = 30,$
$FE = 35,\ FG = 25,$
$OA = 20,\ KG = 25.$
$p = [0.1, 0.3, 0.4, 0.2],$
$T = [8, 7.5, 6, 5.5]$ Н.
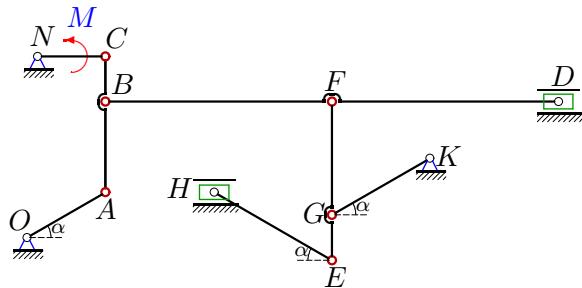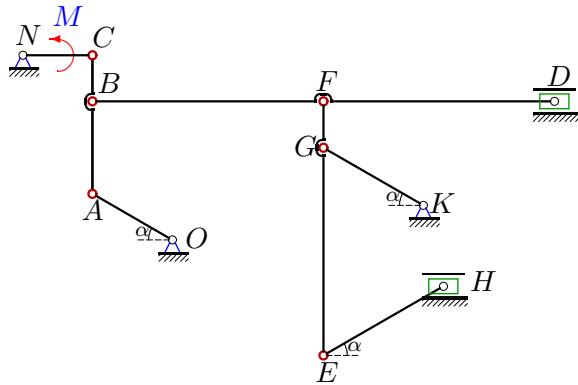
## Задача L-27.16. [1]

$\alpha = 30°,$
$AB = 20,\ BC = 10,$
$BF = 50,\ FD = 50,$
$NC = 15,\ EH = 30,$
$FE = 55,\ FG = 10,$
$OA = 20,\ KG = 25.$
$p = [0.1, 0.3, 0.4, 0.2],$
$T = [8, 7.5, 6.5, 5]$ H.
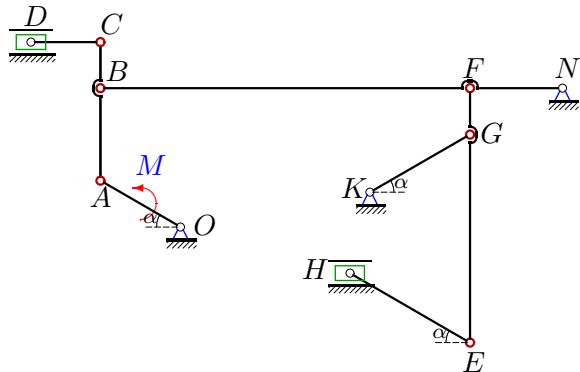
## Задача L-27.17. [1]

$\alpha = 30°,$
$AB = 20,\ BC = 10,$
$BF = 80,\ NF = 20,$
$CD = 15,\ EH = 30,$
$FG = 10,\ GE = 45,$
$OA = 20,\ KG = 25.$
$p = [0.1, 0.3, 0.4, 0.2],$
$T = [8, 7.5, 6, 5.5]$ H.
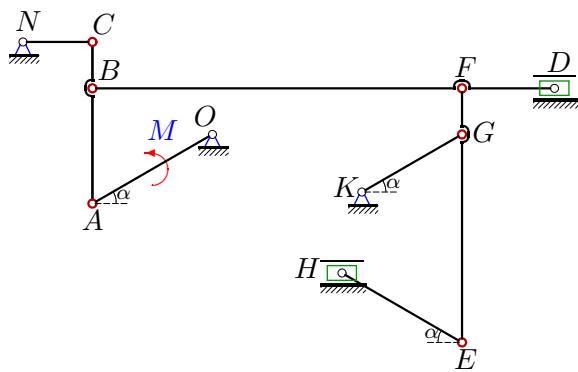
## Задача L-27.18. [1]

$\alpha = 30°,$
$AB = 25,\ BC = 10,$
$BF = 80,\ FD = 20,$
$NC = 15,\ EH = 30,$
$FE = 55,\ FG = 10,$
$OA = 30,\ KG = 25.$
$p = [0.05, 0.35, 0.4, 0.2],$
$T = [8, 7, 6.5, 5.5]$ H.
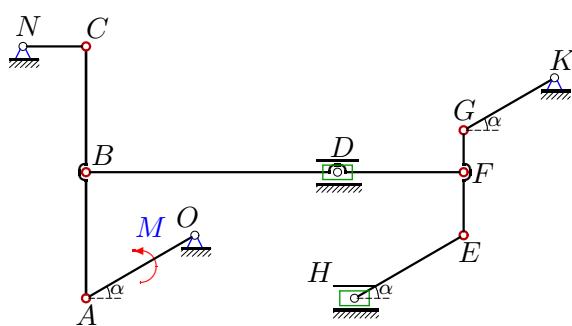
## Задача L-27.19. [1]

$\alpha = 30°,$
$AB = 30,\ BC = 30,$
$DB = 60,\ DF = 30,$
$NC = 15,\ EH = 30,$
$FE = 15,\ FG = 10,$
$OA = 30,\ KG = 25.$
$p = [0.1, 0.3, 0.35, 0.25],$
$T = [8.5, 7, 6.5, 5]$ H.
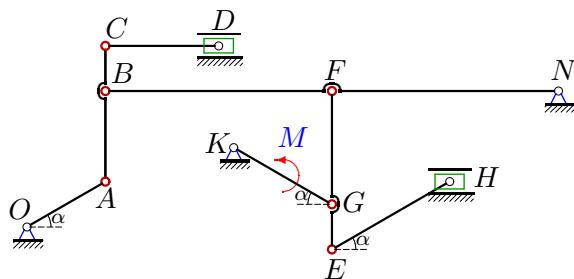
## Задача L-27.20.



$\alpha = 30°$,
$AB = 20,\ BC = 10$,
$BF = 50,\ NF = 50$,
$CD = 25,\ EH = 30$,
$FG = 25,\ GE = 10$,
$OA = 20,\ KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ H.
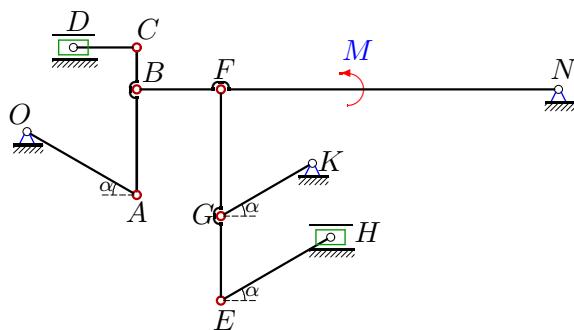
## Задача L-27.21.



$\alpha = 30°$,
$AB = 25,\ BC = 10$,
$BF = 20,\ NF = 80$,
$CD = 15,\ EH = 30$,
$FG = 30,\ GE = 20$,
$OA = 30,\ KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5.5]$ H.
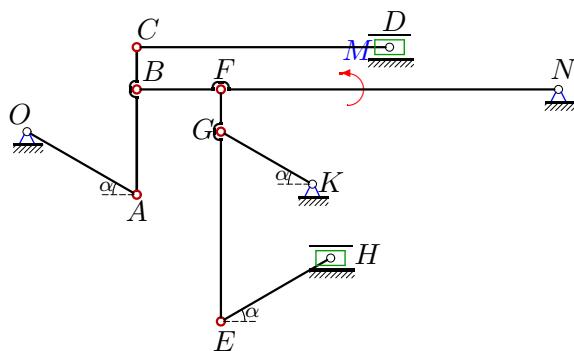
## Задача L-27.22.



$\alpha = 30°$,
$AB = 25,\ BC = 10$,
$BF = 20,\ NF = 80$,
$CD = 60,\ EH = 30$,
$FG = 10,\ GE = 45$,
$OA = 30,\ KG = 25$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5.5]$ H.
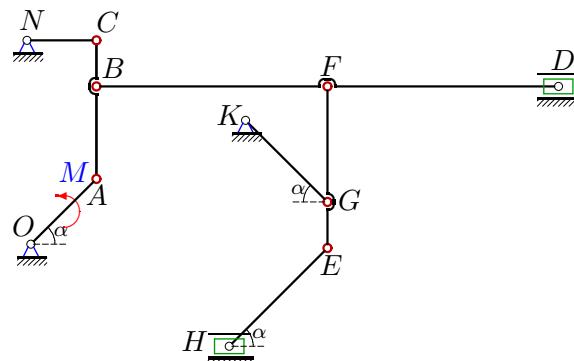
## Задача L-27.23.



$\alpha = 45°$,
$AB = 20,\ BC = 10$,
$BF = 50,\ FD = 50$,
$NC = 15,\ EH = 30$,
$FE = 35,\ FG = 25$,
$OA = 20,\ KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7.5, 6.5, 5]$ H.
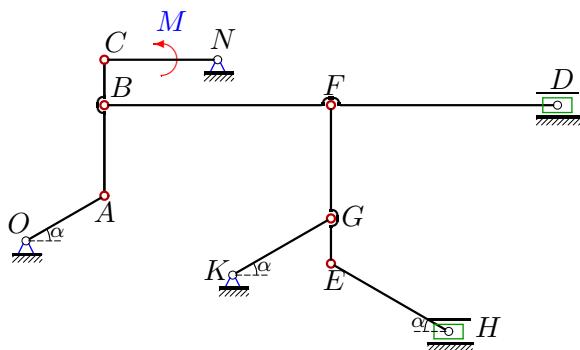
## Задача L-27.24.



$\alpha = 30°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $FD = 50$,
$NC = 25$, $EH = 30$,
$FE = 35$, $FG = 25$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5]$ H.
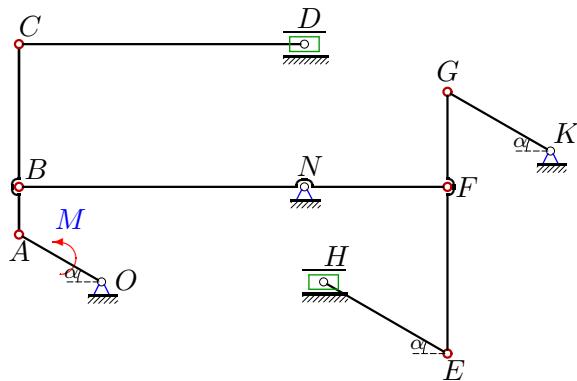
## Задача L-27.25.



$\alpha = 30°$,
$AB = 10$, $BC = 30$,
$NB = 60$, $NF = 30$,
$CD = 60$, $EH = 30$,
$FE = 35$, $FG = 20$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7.5, 6, 5]$ H.
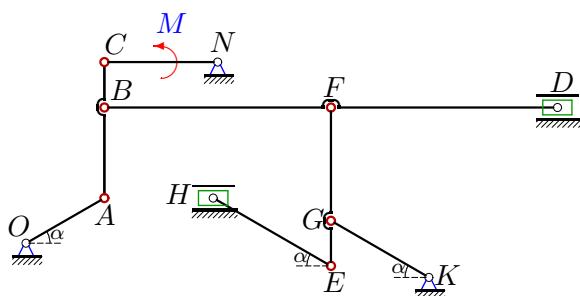
## Задача L-27.26.



$\alpha = 30°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $FD = 50$,
$NC = 25$, $EH = 30$,
$FE = 35$, $FG = 25$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7, 6.5, 5.5]$ H.
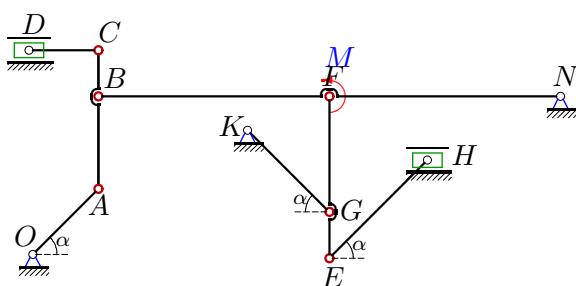
## Задача L-27.27.



$\alpha = 45°$,
$AB = 20$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 15$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 20$, $KG = 25$.
$p = [0.1, 0.3, 0.4, 0.2]$,
$T = [8, 7.5, 6, 5]$ H.
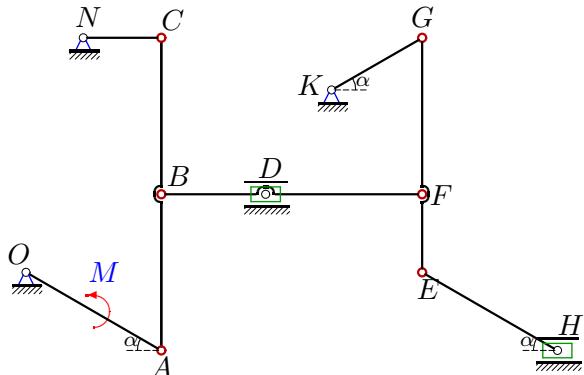
## Задача L-27.28.



$\alpha = 30°$,
$AB = 30$, $BC = 30$,
$DB = 20$, $DF = 30$,
$NC = 15$, $EH = 30$,
$FE = 15$, $FG = 30$,
$OA = 30$, $KG = 20$.
$p = [0.05, 0.35, 0.35, 0.25]$,
$T = [8.5, 7, 6, 5.5]$ H.

## Задача L-27.29.
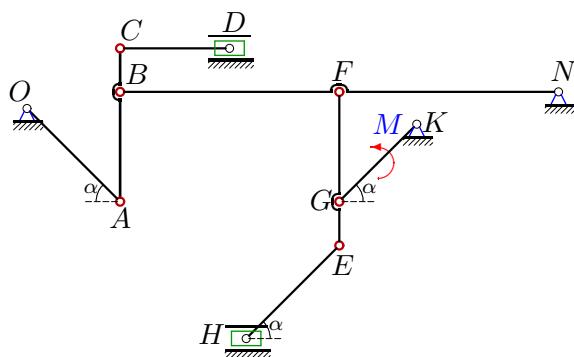


$\alpha = 45°$,
$AB = 25$, $BC = 10$,
$BF = 50$, $NF = 50$,
$CD = 25$, $EH = 30$,
$FG = 25$, $GE = 10$,
$OA = 30$, $KG = 25$.
$p = [0.1, 0.3, 0.35, 0.25]$,
$T = [8.5, 7.5, 6.5, 5]$ H.

## Задача L-27.30.
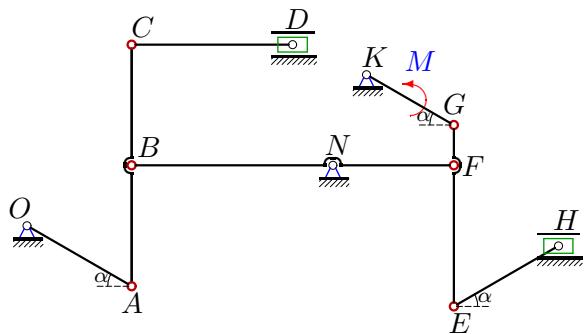


$\alpha = 30°$,
$AB = 30$, $BC = 30$,
$NB = 50$, $NF = 30$,
$CD = 40$, $EH = 30$,
$FE = 35$, $FG = 10$,
$OA = 30$, $KG = 25$.
$p = [0.05, 0.35, 0.4, 0.2]$,
$T = [8, 7.5, 6.5, 5.5]$ H.

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| | $v_A$ | $v_B$ | $v_C$ | $v_D$ | $v_E$ | $v_F$ | $v_G$ | $v_H$ | $M$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 30.000 | 25.981 | 30.000 | 15.000 | 39.051 | 17.321 | 20.000 | 45.000 | 396.000 |
| 2 | 84.853 | 60.000 | 189.737 | 180.000 | 27.042 | 15.000 | 21.213 | 7.500 | 1218.750 |
| 3 | 41.667 | 29.463 | 41.667 | 29.463 | 31.869 | 17.678 | 25.000 | 44.194 | 484.294 |
| 4 | 20.000 | 17.678 | 14.142 | 10.607 | 33.153 | 11.424 | 6.000 | 28.638 | 264.900 |
| 5 | 57.735 | 52.042 | 50.000 | 14.434 | 35.119 | 20.817 | 17.321 | 40.415 | 341.431 |
| 6 | 30.000 | 25.981 | 26.665 | 6.000 | 28.618 | 12.990 | 15.000 | 18.000 | 159.000 |
| 7 | 50.000 | 35.355 | 38.079 | 14.142 | 34.359 | 17.678 | 25.000 | 11.785 | 175.009 |
| 8 | 115.470 | 100.000 | 104.083 | 28.868 | 64.291 | 50.000 | 57.735 | 69.282 | 623.250 |
| 9 | 17.321 | 15.275 | 15.000 | 2.887 | 8.963 | 8.036 | 8.660 | 0.577 | 22.343 |
| 10 | 30.000 | 26.332 | 25.981 | 4.286 | 17.831 | 13.679 | 15.000 | 19.714 | 153.600 |
| 11 | 20.000 | 14.907 | 14.142 | 4.714 | 16.518 | 8.498 | 10.000 | 7.857 | 80.767 |
| 12 | 115.470 | 100.000 | 102.632 | 23.094 | 25.716 | 20.000 | 23.094 | 4.619 | 187.061 |
| 13 | 125.000 | 108.253 | 112.673 | 31.250 | 30.046 | 21.651 | 25.000 | 8.333 | 251.354 |
| 14 | 20.000 | 14.142 | 15.811 | 7.071 | 12.166 | 7.071 | 10.000 | 16.971 | 157.473 |
| 15 | 17.321 | 15.275 | 15.000 | 2.887 | 8.963 | 8.036 | 8.660 | 9.238 | 79.415 |
| 16 | 17.321 | 15.275 | 15.000 | 2.887 | 13.170 | 8.036 | 8.660 | 15.155 | 119.981 |
| 17 | 20.000 | 17.321 | 18.028 | 5.000 | 11.533 | 3.464 | 4.000 | 13.000 | 117.900 |
| 18 | 30.000 | 26.332 | 25.981 | 4.286 | 5.896 | 6.736 | 6.000 | 0.214 | 29.475 |
| 19 | 30.000 | 27.042 | 25.981 | 7.500 | 32.692 | 15.000 | 15.000 | 37.500 | 291.375 |
| 20 | 50.000 | 43.301 | 45.069 | 12.500 | 27.839 | 21.651 | 25.000 | 30.000 | 274.125 |
| 21 | 115.470 | 100.000 | 102.632 | 23.094 | 111.022 | 80.000 | 92.376 | 30.792 | 362.384 |
| 22 | 115.470 | 100.000 | 102.632 | 23.094 | 266.333 | 80.000 | 92.376 | 300.222 | 2053.058 |
| 23 | 20.000 | 14.907 | 14.142 | 4.714 | 13.744 | 8.498 | 10.000 | 18.856 | 156.153 |
| 24 | 28.868 | 25.459 | 25.000 | 4.811 | 14.938 | 13.394 | 14.434 | 15.396 | 127.306 |
| 25 | 20.000 | 17.321 | 34.641 | 30.000 | 12.311 | 8.660 | 10.000 | 13.750 | 282.188 |
| 26 | 28.868 | 25.459 | 25.000 | 4.811 | 17.347 | 13.394 | 14.434 | 4.811 | 63.509 |
| 27 | 141.421 | 100.000 | 111.803 | 50.000 | 86.023 | 50.000 | 70.711 | 120.000 | 1096.500 |
| 28 | 30.000 | 27.042 | 25.981 | 7.500 | 38.971 | 39.686 | 45.000 | 22.500 | 190.500 |
| 29 | 50.000 | 35.355 | 38.079 | 14.142 | 30.414 | 17.678 | 25.000 | 7.071 | 140.537 |
| 30 | 41.667 | 36.084 | 41.667 | 20.833 | 48.814 | 21.651 | 25.000 | 31.250 | 350.260 |

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| № | $\omega_{OA}$ | $\omega_{CA}$ | $\omega_{CD}$ | $\omega_{BF}$ | $\omega_{FE}$ | $\omega_{KG}$ | $\omega_{EH}$ | $\omega_{NC}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.500 | 0.650 | 0.433 | -1.000 | 0.800 | 0.667 | – |
| 2 | 4.243 | -6.000 | 1.000 | 1.000 | 1.500 | -0.849 | -0.707 | – |
| 3 | 1.389 | 0.982 | -0.589 | -0.589 | -1.768 | 1.000 | -0.833 | – |
| 4 | 1.000 | -0.354 | – | -0.283 | -1.485 | 0.240 | 0.200 | -0.283 |
| 5 | -1.925 | -0.481 | – | 1.000 | -1.155 | -0.693 | -0.577 | 1.000 |
| 6 | 1.000 | 0.600 | -1.732 | 0.260 | -0.750 | 0.600 | 0.500 | – |
| 7 | 1.667 | 1.414 | 1.414 | 0.354 | 0.589 | 1.000 | 0.833 | – |
| 8 | -5.774 | 2.887 | 4.000 | 1.000 | -1.155 | -2.309 | -1.925 | – |
| 9 | 0.866 | -0.289 | – | -0.150 | -0.058 | -0.346 | 0.289 | 1.000 |
| 10 | 1.000 | 0.429 | – | -0.260 | -0.471 | 0.600 | -0.500 | -1.039 |
| 11 | 1.000 | -0.471 | – | 0.141 | 0.393 | 0.400 | 0.333 | 0.566 |
| 12 | 3.849 | 2.309 | -6.667 | 1.000 | -0.462 | 0.924 | -0.770 | – |
| 13 | -6.250 | 3.125 | -2.706 | -1.083 | 0.417 | 1.000 | 0.833 | – |
| 14 | 1.000 | -0.707 | -0.566 | -0.141 | -0.283 | -0.400 | 0.333 | – |
| 15 | 0.866 | -0.289 | – | -0.150 | -0.058 | -0.346 | 0.289 | 1.000 |
| 16 | -0.866 | 0.289 | – | -0.150 | 0.144 | -0.346 | -0.289 | 1.000 |
| 17 | 1.000 | -0.500 | -1.155 | 0.173 | 0.200 | -0.160 | -0.133 | – |
| 18 | 1.000 | 0.429 | – | 0.260 | -0.129 | -0.240 | -0.200 | -1.732 |
| 19 | 1.000 | 0.250 | – | 0.433 | 1.500 | -0.600 | 0.500 | -1.732 |
| 20 | 2.500 | -1.250 | -1.732 | -0.433 | 0.500 | 1.000 | -0.833 | – |
| 21 | -3.849 | -2.309 | -6.667 | 1.000 | 1.540 | 3.695 | 3.079 | – |
| 22 | -3.849 | -2.309 | 1.667 | 1.000 | -4.619 | 3.695 | 3.079 | – |
| 23 | 1.000 | -0.471 | – | -0.141 | 0.471 | 0.400 | 0.333 | 0.943 |
| 24 | -1.443 | 0.481 | – | 0.250 | 0.096 | -0.577 | 0.481 | 1.000 |
| 25 | 1.000 | -1.000 | 0.289 | 0.289 | -0.250 | -0.400 | 0.333 | – |
| 26 | -1.443 | 0.481 | – | 0.250 | -0.481 | 0.577 | -0.481 | 1.000 |
| 27 | -7.071 | 5.000 | -6.667 | 1.000 | -2.000 | -2.828 | 2.357 | – |
| 28 | 1.000 | 0.250 | – | -1.299 | -0.500 | -2.250 | 1.500 | 1.732 |
| 29 | -1.667 | -1.414 | 1.414 | 0.354 | 0.707 | 1.000 | -0.833 | – |
| 30 | -1.389 | -0.694 | 0.902 | 0.722 | -1.250 | 1.000 | -0.833 | – |