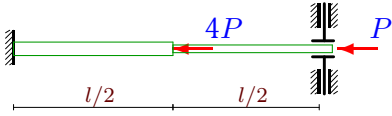# Устойчивость стержня переменного сечения

Прямолинейный стержень длиной l, закрепленный по концам, сжимается одной или двумя продольными силами. Задано соотношение моментов инерции участков стержня. Определить коэффициент μ приведения длины стержня в формуле для критической силы $P_{\text{кр}} = \pi^2 E J / (\mu l)^2$.
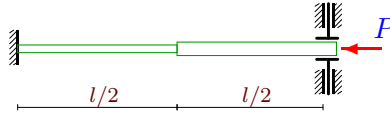
Задача 34.1. *14*

$4P$ P

$l/2$ $l/2$

$J_1 = 1.1J, \ J_2 = J$

Задача 34.2. *14*

P

$l/2$ $l/2$

$J_1 = 0.8J, \ J_2 = J$

Задача 34.3. *14*

P $3P$

$l/2$ $l/2$
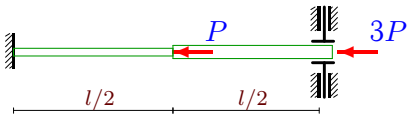
$J_1 = 0.8J, \ J_2 = J$

Задача 34.4. *14*

P P

$l/2$ $l/2$
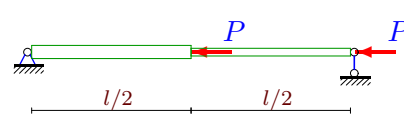
$J_1 = 1.2J, \ J_2 = J$

Задача 34.5. *14*

P

$l/2$ $l/2$
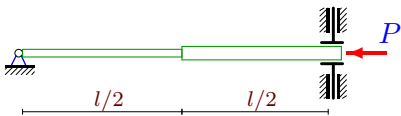
$J_1 = 0.8J, \ J_2 = J$

Задача 34.6. *14*

P $3P$

$l/2$ $l/2$
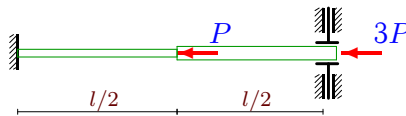
$J_1 = 0.7J, \ J_2 = J$

Задача 34.7. *14*

P P

$l/2$ $l/2$
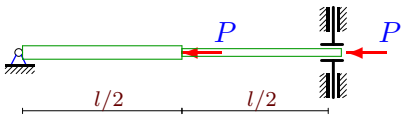
$J_1 = 1.1J, \ J_2 = J$

Задача 34.8. *14*

P

$l/2$ $l/2$
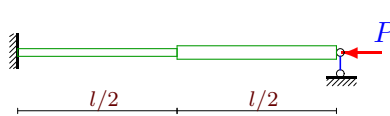
$J_1 = 0.9J, \ J_2 = J$

Задача 34.9. *14*

P

$l/2$ $l/2$
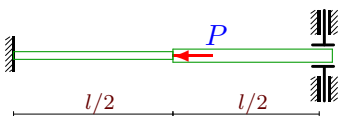
$J_1 = 0.7J, \ J_2 = J$

Задача 34.10. *14*

$4P$ $2P$

$l/2$ $l/2$
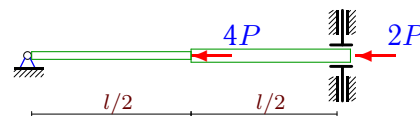
$J_1 = 0.9J, \ J_2 = J$

Задача 34.11.

$l/2$ $l/2$

P

$J_1 = 1.2J,\ J_2 = J$

Задача 34.12.

P

$l/2$ $l/2$
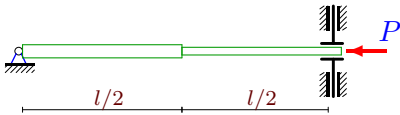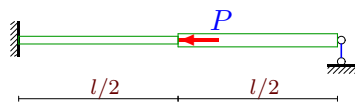
$J_1 = 0.8J,\ J_2 = J$

Задача 34.13.

P P

$l/2$ $l/2$

$J_1 = 0.7J,\ J_2 = J$

Задача 34.14.

$3P$ $4P$

$l/2$ $l/2$
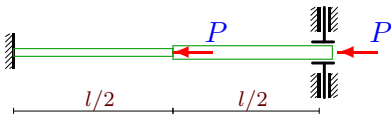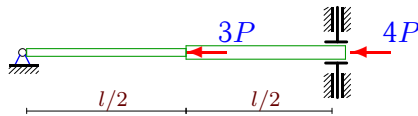
$J_1 = 0.8J,\ J_2 = J$

Задача 34.15.

P

$l/2$ $l/2$

$J_1 = 1.2J,\ J_2 = J$

Задача 34.16.

$2P$ $4P$

$l/2$ $l/2$
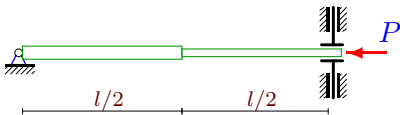
$J_1 = 1.1J,\ J_2 = J$

Задача 34.17.

$3P$ $4P$

$l/2$ $l/2$
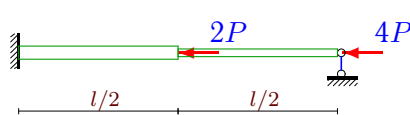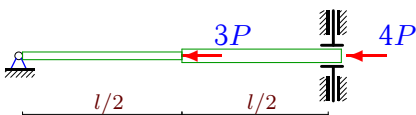
$J_1 = 0.7J,\ J_2 = J$

Задача 34.18.

$4P$ P

$l/2$ $l/2$
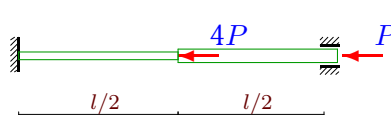
$J_1 = 0.8J,\ J_2 = J$

Задача 34.19.

$4P$ $3P$

$l/2$ $l/2$
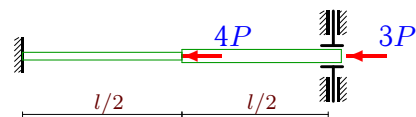
$J_1 = 0.7J,\ J_2 = J$

Задача 34.20.

P P

$l/2$ $l/2$
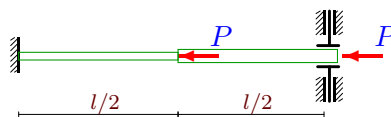
$J_1 = 0.9J,\ J_2 = J$

Задача 34.21.

P

$l/2$ $l/2$

$J_1 = 1.2J,\ J_2 = J$

Задача 34.22.

P $2P$

$l/2$ $l/2$
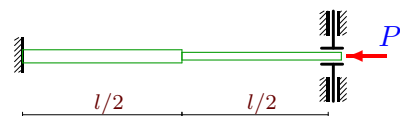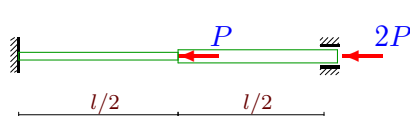
$J_1 = 0.7J,\ J_2 = J$

Задача 34.23.

P $4P$

$l/2$ $l/2$

$J_1 = 0.7J, \ J_2 = J$

Задача 34.24.

P

$l/2$ $l/2$
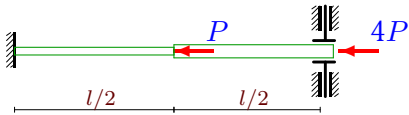
$J_1 = 0.7J, \ J_2 = J$

Задача 34.25.

P P

$l/2$ $l/2$
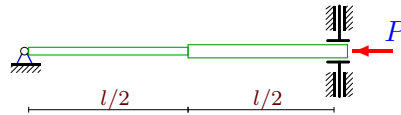
$J_1 = 0.8J, \ J_2 = J$

Задача 34.26.

P $4P$

$l/2$ $l/2$
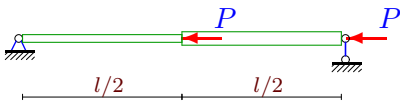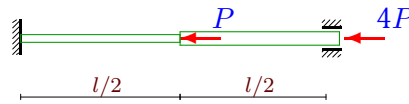
$J_1 = 0.8J, \ J_2 = J$

Задача 34.27.

P

$l/2$ $l/2$
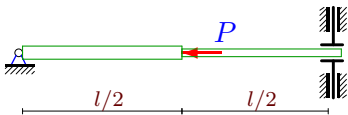
$J_1 = 1.2J, \ J_2 = J$

Задача 34.28.

$4P$ $2P$

$l/2$ $l/2$
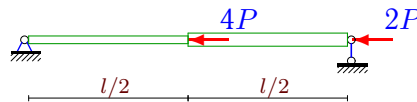
$J_1 = 0.8J, \ J_2 = J$

Задача 34.29.

P $3P$

$l/2$ $l/2$
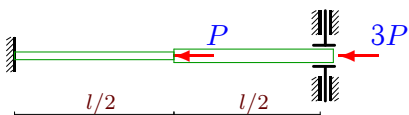
$J_1 = 0.7J, \ J_2 = J$

Задача 34.30.

P

$l/2$ $l/2$
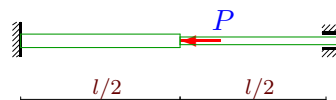
$J_1 = 1.2J, \ J_2 = J$

Задача 34.31.

P

$l/2$ $l/2$
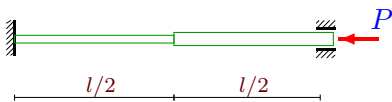
$J_1 = 0.7J, \ J_2 = J$

Задача 34.32.

P P

$l/2$ $l/2$
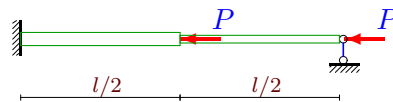
$J_1 = 1.1J, \ J_2 = J$

Задача 34.33.

$2P$ P

$l/2$ $l/2$
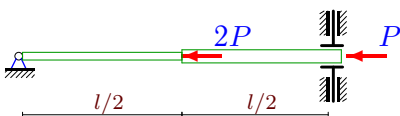
$J_1 = 0.7J, \ J_2 = J$

Задача 34.34.

P P

$l/2$ $l/2$
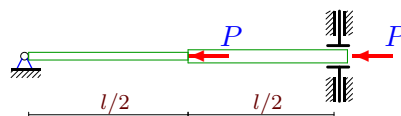
$J_1 = 0.9J, \ J_2 = J$

Устойчивость стержня переменного сечения

1	$Pl^2(4.16C_4^2 + 28.57C_4C_5 + 49.12C_5^2) - EJ(13.59C_4^2 + 93.28C_4C_5 + 161C_5^2)$
2	$Pl^2(1.22C_4^2 + 8.52C_4C_5 + 14.92C_5^2) - EJ(11.22C_4^2 + 77.45C_4C_5 + 134.43C_5^2)$
3	$Pl^2(4.4C_4^2 + 30.58C_4C_5 + 53.31C_5^2) - EJ(11.22C_4^2 + 77.45C_4C_5 + 134.43C_5^2)$
4	$Pl^2(0.73C_4^2 + 3.61C_4C_5 + 4.49C_5^2) - EJ(5.28C_4^2 + 26.15C_4C_5 + 32.9C_5^2)$
5	$Pl^2(31.09C_4^2 + 197.86C_4C_5 + 314.92C_5^2) - EJ(73.62C_4^2 + 469.45C_4C_5 + 750.05C_5^2)$
6	$Pl^2(4.4C_4^2 + 30.58C_4C_5 + 53.31C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
7	$Pl^2(56.75C_4^2 + 360.24C_4C_5 + 571.78C_5^2) - EJ(78.39C_4^2 + 497.27C_4C_5 + 790.69C_5^2)$
8	$Pl^2(0.09C_4^2 + 0.49C_4C_5 + 0.7C_5^2) - EJ(1.71C_4^2 + 9.55C_4C_5 + 13.57C_5^2)$
9	$Pl^2(0.73C_4^2 + 5.01C_4C_5 + 8.55C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
10	$Pl^2(164.84C_4^2 + 1045.26C_4C_5 + 1657.27C_5^2) - EJ(75.21C_4^2 + 478.73C_4C_5 + 763.6C_5^2)$
11	$Pl^2(31.09C_4^2 + 197.86C_4C_5 + 314.92C_5^2) - EJ(79.98C_4^2 + 506.55C_4C_5 + 804.23C_5^2)$
12	$Pl^2(0.04C_4^2 + 0.2C_4C_5 + 0.26C_5^2) - EJ(1.62C_4^2 + 9.1C_4C_5 + 13C_5^2)$
13	$Pl^2(1.95C_4^2 + 13.53C_4C_5 + 23.47C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
14	$Pl^2(201.35C_4^2 + 1278.59C_4C_5 + 2030.26C_5^2) - EJ(73.62C_4^2 + 469.45C_4C_5 + 750.05C_5^2)$
15	$Pl^2(31.09C_4^2 + 197.86C_4C_5 + 314.92C_5^2) - EJ(79.98C_4^2 + 506.55C_4C_5 + 804.23C_5^2)$
16	$Pl^2(0.41C_4^2 + 2.33C_4C_5 + 3.3C_5^2) - EJ(1.89C_4^2 + 10.45C_4C_5 + 14.71C_5^2)$
17	$Pl^2(201.35C_4^2 + 1278.59C_4C_5 + 2030.26C_5^2) - EJ(72.03C_4^2 + 460.17C_4C_5 + 736.5C_5^2)$
18	$Pl^2(5.71 \cdot 10^{-2}C_4^2 + 0.28C_4C_5 + 0.35C_5^2) - EJ(0.72C_4^2 + 3.65C_4C_5 + 4.75C_5^2)$
19	$Pl^2(6.6C_4^2 + 45.61C_4C_5 + 78.97C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
20	$Pl^2(1.95C_4^2 + 13.53C_4C_5 + 23.47C_5^2) - EJ(12C_4^2 + 82.72C_4C_5 + 143.29C_5^2)$
21	$Pl^2(1.22C_4^2 + 8.52C_4C_5 + 14.92C_5^2) - EJ(14.38C_4^2 + 98.55C_4C_5 + 169.86C_5^2)$
22	$Pl^2(4.76 \cdot 10^{-2}C_4^2 + 0.24C_4C_5 + 0.3C_5^2) - EJ(0.68C_4^2 + 3.47C_4C_5 + 4.56C_5^2)$
23	$Pl^2(5.61C_4^2 + 39.1C_4C_5 + 68.23C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
24	$Pl^2(31.09C_4^2 + 197.86C_4C_5 + 314.92C_5^2) - EJ(72.03C_4^2 + 460.17C_4C_5 + 736.5C_5^2)$
25	$Pl^2(0.73C_4^2 + 3.61C_4C_5 + 4.49C_5^2) - EJ(4.32C_4^2 + 21.85C_4C_5 + 28.05C_5^2)$
26	$Pl^2(8.57 \cdot 10^{-2}C_4^2 + 0.43C_4C_5 + 0.54C_5^2) - EJ(0.72C_4^2 + 3.65C_4C_5 + 4.75C_5^2)$
27	$Pl^2(25.67C_4^2 + 162.39C_4C_5 + 256.86C_5^2) - EJ(79.98C_4^2 + 506.55C_4C_5 + 804.23C_5^2)$
28	$Pl^2(1.94C_4^2 + 9.58C_4C_5 + 11.86C_5^2) - EJ(4.32C_4^2 + 21.85C_4C_5 + 28.05C_5^2)$
29	$Pl^2(4.4C_4^2 + 30.58C_4C_5 + 53.31C_5^2) - EJ(10.43C_4^2 + 72.18C_4C_5 + 125.57C_5^2)$
30	$Pl^2(0.95 \cdot 10^{-2}C_4^2 + 0.05C_4C_5 + 0.06C_5^2) - EJ(0.88C_4^2 + 4.35C_4C_5 + 5.53C_5^2)$
31	$Pl^2(1.9 \cdot 10^{-2}C_4^2 + 0.1C_4C_5 + 0.12C_5^2) - EJ(0.68C_4^2 + 3.47C_4C_5 + 4.56C_5^2)$
32	$Pl^2(0.12C_4^2 + 0.68C_4C_5 + 0.96C_5^2) - EJ(1.89C_4^2 + 10.45C_4C_5 + 14.71C_5^2)$
33	$Pl^2(82.42C_4^2 + 522.63C_4C_5 + 828.64C_5^2) - EJ(72.03C_4^2 + 460.17C_4C_5 + 736.5C_5^2)$
34	$Pl^2(56.75C_4^2 + 360.24C_4C_5 + 571.78C_5^2) - EJ(75.21C_4^2 + 478.73C_4C_5 + 763.6C_5^2)$

№	μ	
1	1.738	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
2	1.055	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
3	1.983	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
4	1.167	$C_0 = 0,\ C_1 = C_4 + (7/3)C_5,\ C_2 = 0,\ C_3 = -2C_4 - (10/3)C_5$
5	2.043	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
6	2.048	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
7	2.673	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
8	0.710	$C_0 = 0,\ C_1 = 0,\ C_2 = (3C_4 + 7C_5)/2,\ C_3 = -(5C_4 + 9C_5)/2$
9	0.850	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
10	4.666	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
11	1.968	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
12	0.473	$C_0 = 0,\ C_1 = 0,\ C_2 = (3C_4 + 7C_5)/2,\ C_3 = -(5C_4 + 9C_5)/2$
13	1.360	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
14	5.218	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
15	1.968	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
16	1.490	$C_0 = 0,\ C_1 = 0,\ C_2 = (3C_4 + 7C_5)/2,\ C_3 = -(5C_4 + 9C_5)/2$
17	5.303	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
18	0.913	$C_0 = 0,\ C_1 = 0,\ C_2 = C_4 + 2C_5,\ C_3 = -2C_4 - 3C_5$
19	2.498	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
20	1.272	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
21	0.954	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
22	0.852	$C_0 = 0,\ C_1 = 0,\ C_2 = C_4 + 2C_5,\ C_3 = -2C_4 - 3C_5$
23	2.318	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
24	2.072	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
25	1.313	$C_0 = 0,\ C_1 = C_4 + (7/3)C_5,\ C_2 = 0,\ C_3 = -2C_4 - (10/3)C_5$
26	1.094	$C_0 = 0,\ C_1 = 0,\ C_2 = C_4 + 2C_5,\ C_3 = -2C_4 - 3C_5$
27	1.780	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
28	2.160	$C_0 = 0,\ C_1 = C_4 + (7/3)C_5,\ C_2 = 0,\ C_3 = -2C_4 - (10/3)C_5$
29	2.048	$C_0 = 0,\ C_1 = 0,\ C_2 = 4C_4 + (25/2)C_5, C_3 = -4C_4 - 10C_5$
30	0.329	$C_0 = 0,\ C_1 = 0,\ C_2 = C_4 + 2C_5,\ C_3 = -2C_4 - 3C_5$
31	0.534	$C_0 = 0,\ C_1 = 0,\ C_2 = C_4 + 2C_5,\ C_3 = -2C_4 - 3C_5$
32	0.801	$C_0 = 0,\ C_1 = 0,\ C_2 = (3C_4 + 7C_5)/2,\ C_3 = -(5C_4 + 9C_5)/2$
33	3.409	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$
34	2.734	$C_0 = 0,\ C_1 = 8C_4 + 25C_5,\ C_2 = 0,\ C_3 = -4C_4 - 10C_5$