Parametry nosníku

In[153]:=
```
Remove["Global`*"];
```

In[154]:=
```
younguvModul = 210 × 10^9; sirka = 0.02; vyska = 0.00094; delka = 0.203;
momentSetrvacnostiPrurezu = 1/12 sirka * vyska^3; hustotaOceli = 7800; plocha = sirka * vyska;
```

Mód 1

Konstanta k (řešení transcendentní rovnice)

In[155]:=
```
n = 1; k[n] = 1.875/delka;
```

Úhlová frekvence Ω, frekvence f

In[156]:=
```
Ω[n] = k[n]^2 * Sqrt[younguvModul * momentSetrvacnostiPrurezu / (hustotaOceli * plocha)]
```

Out[156]= 120.119

In[157]:=
```
f[n] = Ω[n]/(2 * π)
```

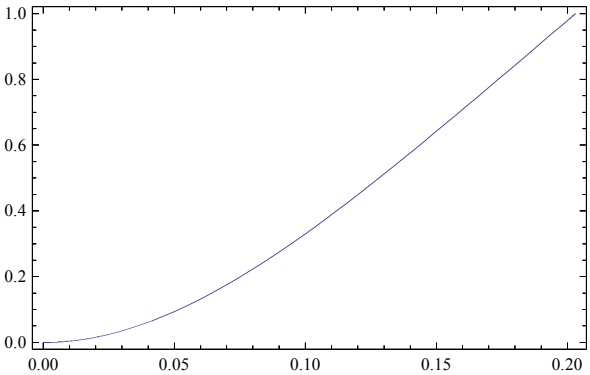
Out[157]= 19.1175

Průhybová křivka (normalizovaná)

In[158]:=
```
w[n][x_] = (Sinh[k[n] * delka] + Sin[k[n] * delka]) * (Cosh[k[n] * x] - Cos[k[n] * x]) -
    (Cosh[k[n] * delka] + Cos[k[n] * delka]) * (Sinh[k[n] * x] - Sin[k[n] * x]);
```

In[159]:=
```
Plot[w[n][x]/w[n][delka], {x, 0, delka}, Frame → True]
```

Out[159]=



Mód 2

Konstanta k (řešení transcendentní rovnice)

In[160]:=
```
n = 2; k[n] = 4.694 / delka;
```

Úhlová frekvence Ω, frekvence f

In[161]:=
```
Ω[n] = k[n]^2 * Sqrt[younguvModul * momentSetrvacnostiPrurezu / (hustotaOceli * plocha)]
```

Out[161]= 752.824

In[162]:=
```
f[n] = Ω[n] / (2 * π)
```

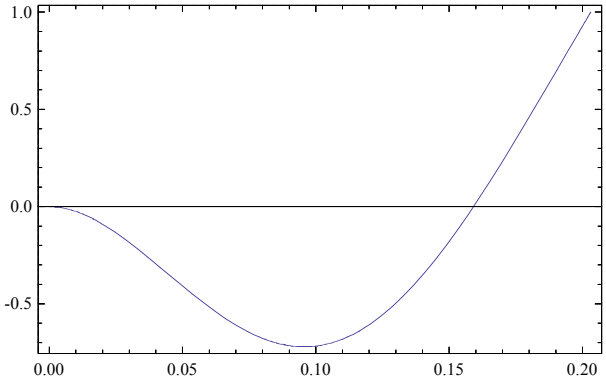
Out[162]= 119.816

Průhybová křivka (normalizovaná)

In[163]:=
```
w[n][x_] = (Sinh[k[n] * delka] + Sin[k[n] * delka]) * (Cosh[k[n] * x] - Cos[k[n] * x]) -
    (Cosh[k[n] * delka] + Cos[k[n] * delka]) * (Sinh[k[n] * x] - Sin[k[n] * x]);
```

In[164]:=
```
Plot[w[n][x] / w[n][delka], {x, 0, delka}, Frame → True]
```

Out[164]=



Umístění uzlu

In[165]:=
```
FindRoot[w[n][x] == 0, {x, 0.1}]
```

Out[165]= {x → 0.159042}

Mód 3

Konstanta k (řešení transcendentní rovnice)

In[166]:=
$$n = 3;\ k[n] = \frac{(2 * n - 1) * \pi}{2 * delka};$$

Úhlová frekvence Ω, frekvence f

In[167]:=
$$\Omega[n] = k[n]^2 * \sqrt{\frac{younguvModul * momentSetrvacnostiPrurezu}{hustotaOceli * plocha}}$$

Out[167]= 2107.6

In[168]:=
$$f[n] = \frac{\Omega[n]}{2 * \pi}$$

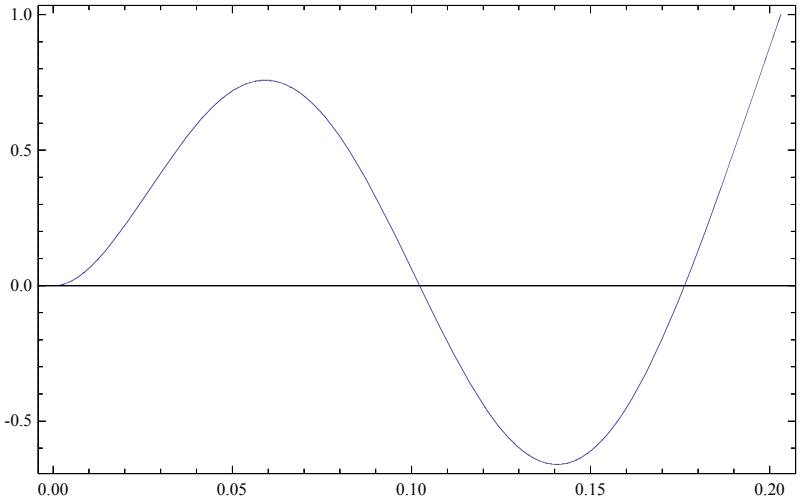
Out[168]= 335.434

Průhybová křivka (normalizovaná)

In[169]:=
```
w[n][x_] = (Sinh[k[n] * delka] + Sin[k[n] * delka]) * (Cosh[k[n] * x] - Cos[k[n] * x]) -
    (Cosh[k[n] * delka] + Cos[k[n] * delka]) * (Sinh[k[n] * x] - Sin[k[n] * x]);
```

In[170]:=
```
Plot[w[n][x] / w[n][delka], {x, 0, delka}, Frame → True]
```

Out[170]=



Umístění uzlů

In[171]:=
```
FindRoot[w[n][x] == 0, {x, 0.1}]
```

Out[171]= {x → 0.10223}

In[172]:=
```
FindRoot[w[n][x] == 0, {x, 0.18}]
```

Out[172]= {x → 0.176156}

Mód 4

Konstanta k (řešení transcendentní rovnice)

In[173]:=
$$n = 4;\ k[n] = \frac{(2 * n - 1) * \pi}{2 * delka};$$

Úhlová frekvence Ω, frekvence f

In[174]:=
$$\Omega[n] = k[n]^2 * \sqrt{\frac{younguvModul * momentSetrvacnostiPrurezu}{hustotaOceli * plocha}}$$

Out[174]= 4130.89

In[175]:=
$$f[n] = \frac{\Omega[n]}{2 * \pi}$$

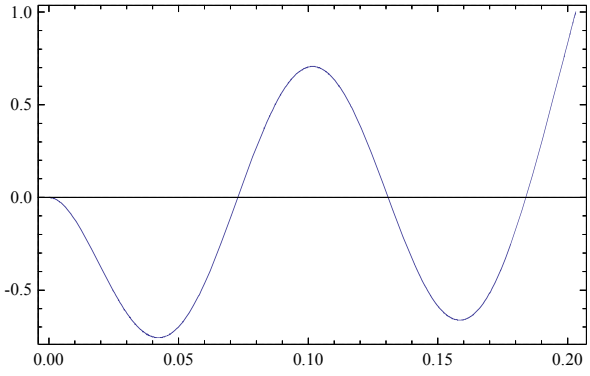
Out[175]= 657.451

Průhybová křivka (normalizovaná)

In[176]:=
```
w[n][x_] = (Sinh[k[n] * delka] + Sin[k[n] * delka]) * (Cosh[k[n] * x] - Cos[k[n] * x]) -
    (Cosh[k[n] * delka] + Cos[k[n] * delka]) * (Sinh[k[n] * x] - Sin[k[n] * x]);
```

In[177]:=
```
Plot[w[n][x] / w[n][delka], {x, 0, delka}, Frame → True]
```

Out[177]=



Umístění uzlů

In[178]:=
```
FindRoot[w[n][x] == 0, {x, 0.06}]
```

Out[178]= {x → 0.0727423}

In[179]:=
```
FindRoot[w[n][x] == 0, {x, 0.14}]
```

Out[179]= {x → 0.130749}

In[180]:=
```
FindRoot[w[n][x] == 0, {x, 0.18}]
```

Out[180]= {x → 0.183829}