axlecalculation

January 31, 2017

1 Example axle calculation

Illustrate the creation of an axle calculation report. The formula's are mostly based on **Roloff/Matek - Maschinelemente** which can be found here (Springer link)[http://link.springer.com/book/10.1007%2F978-3-658-09082-1]

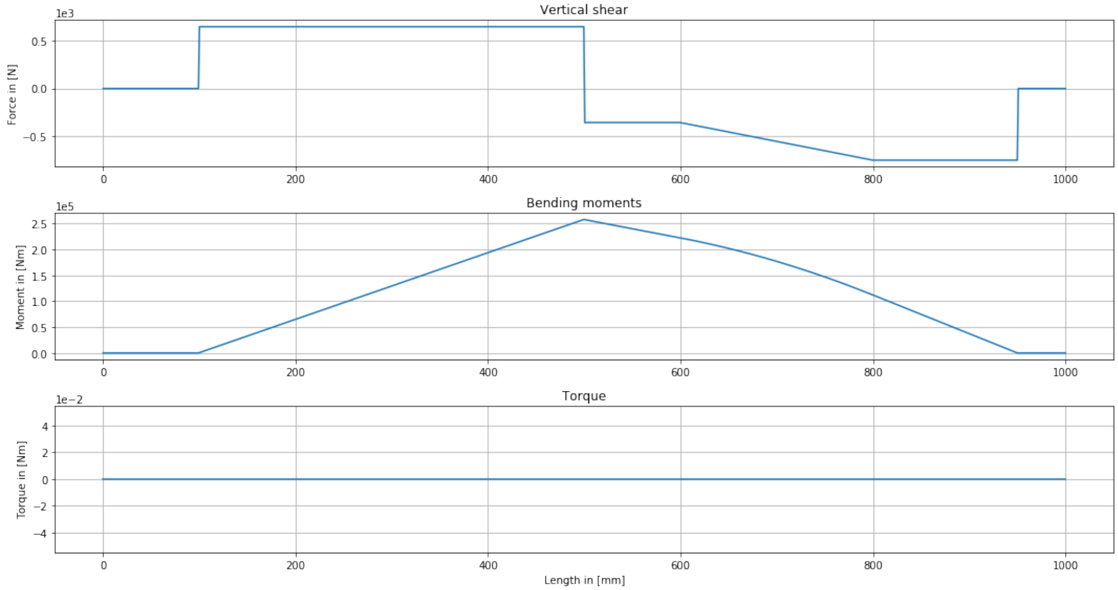
```
In [1]: import matplotlib.pyplot as pl
        %matplotlib inline
        from IPython.display import display, Latex, Math
        from pymech.units.SI import ureg, Q_

        import pymech.fmt as fmt
        from pymech.materials.Steel import Steel
        from pymech.materials.ApplianceFactor import ApplianceFactor, Bumps
        from pymech.axle.Properties import Properties
        from pymech.axle.Axle import Axle
```

```
In [4]: prop = Properties()
        prop.geometry = fmt.Geometry(1000)
        prop.geometry.addpoint(fmt.Point(100, known=False))
        prop.geometry.addpoint(fmt.Point(500, f=500.))
        prop.geometry.addweight(fmt.Point(600), fmt.Point(800), 20.)
        prop.geometry.addpoint(fmt.Point(950, known=False))

        prop.material = Steel()
        prop.material.load(filename='../pymech/resources/materials/S235JR.mat')
        prop.appliancefactor = ApplianceFactor(drivingmachine=Bumps.NO_BUMPS, machine=Bumps.LIGH
```

```
In [5]: axle = Axle(properties=prop)
        axle.solvegeometry()
        axle.plotfmt(figsize=(15,8))
```




```
In [6]: d_prime = axle.d_prime(pretty=True)
        d_prime[1]
```

Out[6]:

$$M_b = K_A \max(M_{nom}) \times \to 1.10 \times 2.58 \cdot 10^5 \left[\frac{N}{m^2}\right] = 2.84 \cdot 10^5 \left[\frac{N}{m^2}\right]$$

$$d' = \approx 3.4 \sqrt[3]{\frac{M_b}{\sigma_{bWN}}} \to 3.4[m] \sqrt[3]{\frac{2.84 \cdot 10^5 \left[\frac{N}{m^2}\right]}{1.80 \cdot 10^2 [MPa]}} \approx 3.96 \cdot 10^{-1} \, [m]$$

```
In [7]: k = 0.5
        d_a = axle.d_a(k=k, pretty=True)
        d_a[1]
```

Out[7]:

$$M_b = K_A \max(M_{nom}) \times \to 1.10 \times 2.58 \cdot 10^5 \left[\frac{N}{m^2}\right] = 2.84 \cdot 10^5 \left[\frac{N}{m^2}\right]$$

$$d_a = \approx 3.4 \sqrt[3]{\frac{M_b}{(1-k^4)\sigma_{bWN}}} \to 3.4[m] \sqrt[3]{\frac{2.84 \cdot 10^5 \left[\frac{N}{m^2}\right]}{(1-0.5^4) 1.80 \cdot 10^2 [MPa]}} \approx 4.04 \cdot 10^{-1} \, [m]$$

```
In [ ]:
```