

## Stability of structures

### Home exercises 3 and 4

**Home exercise 3.** Determine the asymptotic post-buckling behaviour of the column in exercise 1.

**Hint.** Start from the exact expression of the curvature (in Lagrangian formulation)

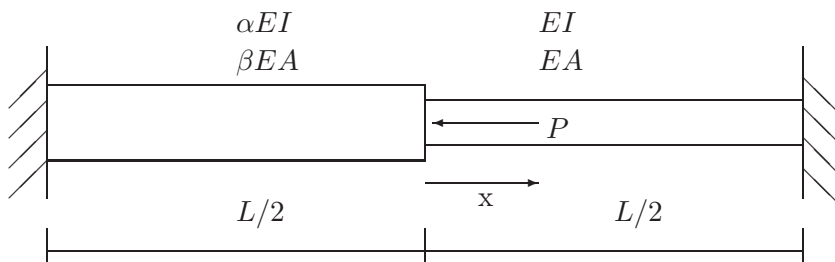
$$\kappa = \frac{v''}{\sqrt{1 - (v')^2}}$$

resulting in the potential energy expression

$$\Pi(v) = \frac{1}{2} \int_0^L EI \kappa^2 dx - P \int_0^L \left(1 - \sqrt{1 - (v')^2}\right) dx.$$

Use series expansion up to fourth order and the displacement field in the form  $v(x) = av_1(x)$  where  $a$  is the unknown amplitude and  $v_1(x)$  is the buckling mode corresponding to the lowest buckling load.

**Home exercise 4.** For the structure shown below determine  $P_{cr}$  starting from the differential equation. You can use the following values for the non-dimensional coefficients:  $\alpha = 2$ ,  $\beta = 1$ . Compare the results to problem 2 in exercise 4, what are your conclusions?



Solutions to the home exercises should be returned as pdf-files in the Moodle area of the course at latest 3.3.2019.