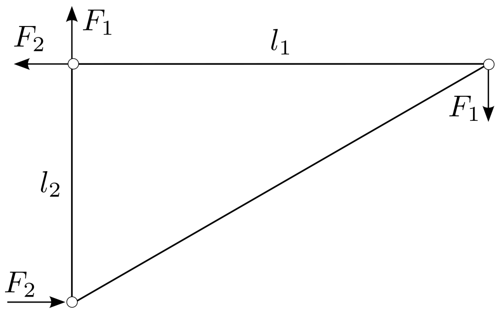
Course of Aerospace Structures

Written test, September 2^{nd}, 2019

Exercise 1

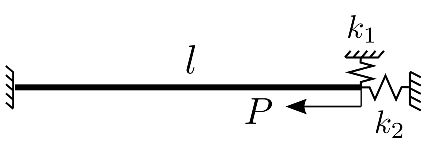
A structure is made of three bars connected each other through hinge constraints. The bars are made of aluminum alloy with Young's modulus E and have area A. A set of loads is applied at the end of the bars, the concentrated loads being denoted as F_1 and F_2, as shown in the figure.
By using a displacement-based approach, determine the internal stresses in the three bars.



Data
$l_1 = 600$ mm; $l_2 = 200$ mm;
$A = 400$ mm^2;
$E = 70$ GPa;
$F_1 = 1.0 \times 10^4$ N; $F_2 = 3.0 \times 10^4$ N;

Exercise 2

Consider the elastically restrained column in the figure. Specifically, the column has length l and a square section of dimension a. The material is an aluminum alloy characterized by Young's moduli E. One end is fixed and the second one is grounded by means of two linear springs of stiffness k_1 and k_2. A compressive load P is applied at one end.
Estimate the buckling load of the structure by resorting to a displacement-based approach along with an appropriate approximate solution strategy.



Data
$l = 1200$ mm;
$a = 20$ mm;
$E = 70$ GPa;
$k_1 = 1$ N/mm; $k_2 = 10$ kN/mm;

Question 1

Illustrate how to estimate the torsional and transverse shear stiffnesses for a thin-walled beam in the context of the semi-monocoque approximation.