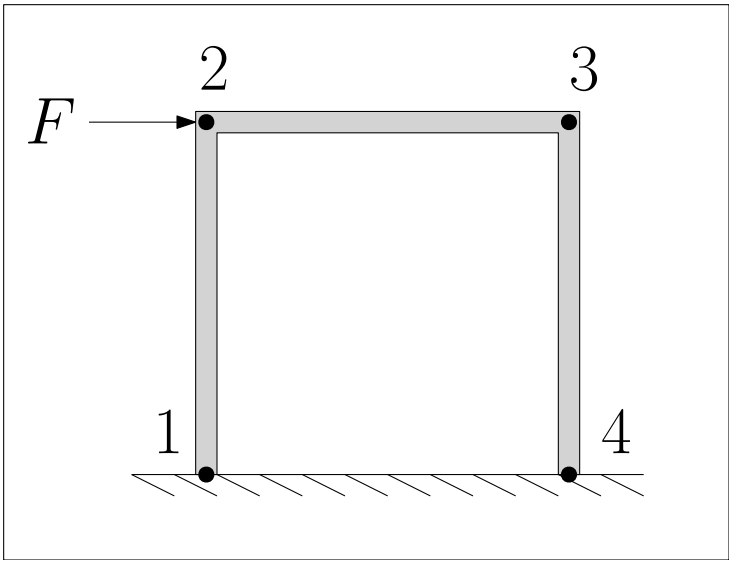
2D static FEA analysis of beams: bad conditioning

Consider a frame composed of a floor and two poles, which is submitted to a lateral load.



The poles are modeled as pure bending beams (no shear deformation) and the floor as beam deforming both in bending and traction. The problem can be simplfy considering that the floor is infinitely rigid in bending (the rotations at nodes 2 and 3 are zero) and the floor deforms only axially.

1. Express the stiffness matrix of the free-body structure.
2. Decompose the stiffness matrix of the algebraic system of equations to solve, while taking into account the boundary conditions of the clamped poles.
3. Solve the algebraic system of equations for a unit-norm lateral load while keeping for the stiffness matrix:
   - four significant digits,
   - six significant digits.

Floor	Poles
L $= 3.45$ $[\mathrm{m}]$	L $= 3.45$ $[\mathrm{m}]$
	$t = 2$ $\cdot 10^{-3}$ $[\mathrm{m}]$

Floor	Poles
$A = 3.45 \cdot 10^{-2}\ [\mathrm{m}^2]$	
$E = 20 \cdot 10^{10}\ [\mathrm{N/m}^2]$	$R = 10^{-1}\ [\mathrm{m}]$
	$I = \pi R^3 t$
	$E = 20 \cdot 10^{10}\ [\mathrm{N/m}^2]$