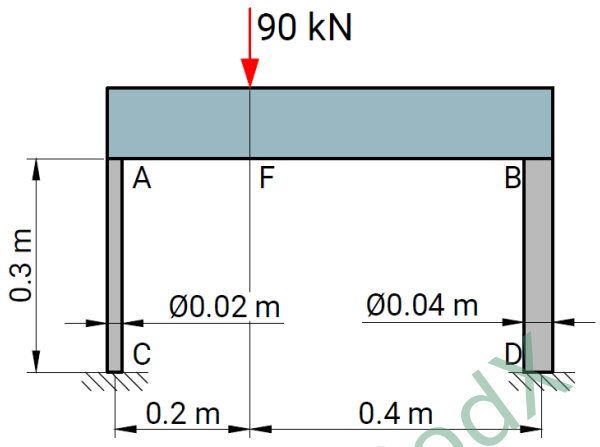
Problem 2

Figure



Description

A rigid horizontal beam AB is supported by two vertical posts as shown.

Post AC is made of steel with a diameter of 20 mm, and post BD is made of aluminum with a diameter of 40 mm. The beam is rigid, and a vertical load of 90 kN is applied at point F, located 200 mm from A and 400 mm from B. The height of each post is 300 mm.

Given the material properties

$E_{st} = 2.0\times10^{8}$ kN/m^2

$E_{al} = 7.0\times10^{7}$ kN/m^2

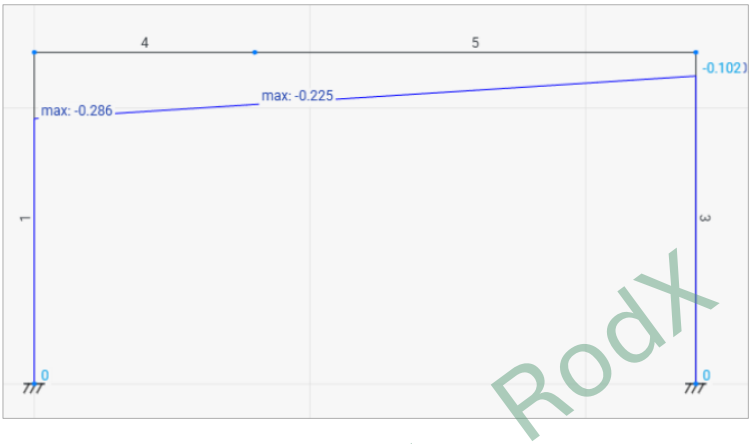
Determine:

- Vertical displacement of point F on the rigid beam

Model

Units:	m, kN
Element:	Beam element
Material:	Steel, E = 2.0×10^{8} kN/m^2; Aluminum, E = 7.0×10^{7} kN/m^2
Section property:	D (steel bar) = 0.02 m; D (aluminum bar) = 0.04 m
Constraints:	Fixed at point C, D
Load Case:	Beam concentrated load –90 kN are applied at nodes F in the Y direction.

Results



Project Title:			Untitled Project	
Load Case/Combination:			LC0 - Default Case	
Units:			mm	
Element	x/L	Ux	Uy	Ur
1	0	0	0	0
1	1	-0.0461	-0.2864	0.000306
3	0	-0.0461	-0.10237	0.000308
3	1	0	0	0
4	0	-0.0461	-0.2864	0.000306
4	1	-0.0461	-0.22525	0.000306
5	0	-0.0461	-0.22525	0.000306
5	1	-0.0461	-0.10237	0.000308

Comparison of Results

Node	Deformation, mm		
	Theoretical	RodX	Midas/Civil
Δx(A)	–0.286	–0.286	–0.286
Δx(F)	–0.225	–0.225	–0.225
Δx(D)	–0.102	–0.102	–0.102

Reference

1. Hibbeler R. C, Mechanics of Materials, 10th Edition in SI units, 2017, Pearson, example 4.3, p.149