CE 525 Fall 2024 FINAL PROJECT
Due December 10, 2:30pm ET

For the 2D truss shown:

P

d_2

d_1

2 m

$30°$ $30°$
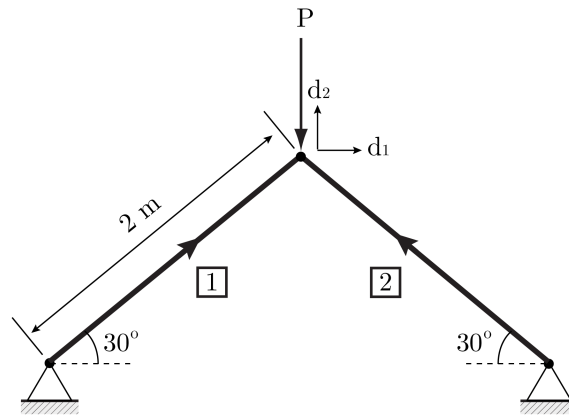
$E = 75$ GPa; $A = 750$ mm² for all members

a. (40 pts) Write a computer program to perform a nonlinear* geometric analysis based on the matrix displacement method (MDM) to determine the *joint displacements*, *axial bar forces*, and *support reactions* in loading increments of $\{P\} = 0, 500, 1000, 1500, 2000, 2500, 3000$ kN. Plot the applied force $\{P\}$ versus displacements $\{d\}$.

b. (10 pts) Compare **Part (a)** with a *linear analysis* and comment on results.

c. (20 pts) Apply load $\{P\} = 5000$ kN, in 5.0 kN increments, and plot force $\{P\}$ versus displacements $\{d\}$.

d. (10 pts) Compare **Part (c)** with a *linear analysis* and comment on results.

e. (20 pts) Using the maximum displacements $\{d\}$ obtained in **Part (c)**, subdivide into 1000 incremental steps and calculate the corresponding loads $\{P\}$ using the nonlinear geometric relationship and plot force versus applied displacements. Compare with the analysis results from **Parts (c, d)**.

f. BONUS: (5 pts) Re-solve **Part (a)** using the *Modified Newton Raphson* approach and comment on results.

SUBMIT: (1) A *hardcopy* (.pdf) technical report in the same format as HW assignments.

(2) A *softcopy* of your computer code(s) with instructions on how to run.

*Use a convergence tolerance of $\varepsilon = 1e\text{-}8$.