Problem 11.20. Cantilever with mid-span load and tip support

Consider the cantilever beam of length $2L$ shown in fig. 11.50. A concentrated load is applied at mid-span and the tip is pinned. Construct a finite element solution to this problem using two elements of length L. *(1)* Determine the nodal displacements and rotations and compare to the exact results obtained using the unit load method. *(2)* Determine the nodal reactions for the constrained degrees of freedom. *(3)* Construct a plot of the deflected shape for the beam.

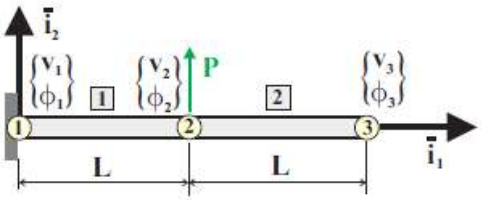

Fig. 11.50. Cantilever with tip support and concentrated load applied at mid-span.

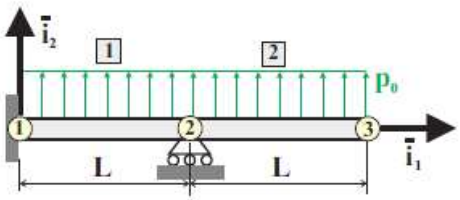

Fig. 11.51. Cantilever with mid-span support and a uniform load.

Problem 11.21. Cantilever with mid-span support and uniform load

A cantilever beam is supported at mid-span and carries a uniform load p_0 as shown in fig. 11.51. (Note that this is very similar to example above.) Construct a finite element solution to this problem using two elements of length L. *(1)* determine the nodal displacements and rotations and compare to the exact results obtained using the unit load method. *(2)* Determine the nodal reactions for the constrained degrees of freedom. *(3)* Construct a plot of the deflected shape for the beam.

Problem 11.22. Simply supported beam with nonuniform bending stiffness

In this problem you are to reconsider the simply supported beam with nonuniform bending stiffness treated in problem 11.12. The present solution is to be developed using the finite element approach. Construct a 2-element solution using elements for the left and right halves of the beam. *(1)* Compute the nodal displacements and rotations at each node. *(2)* Compare the solution for the mid-span deflection with the exact solution computed using the unit load method. *(3)* Compare the solution for the mid-span deflection with the solution from problem 11.12.