

EG3111 Finite Element Analysis and Design

Exercise sheet #4: Beam and Frame Elements

Questions

1. Use two beam elements to solve the problem of a beam of length $2L$ fixed at both ends subject to a vertical load P N at the centre, as shown in Figure 1.

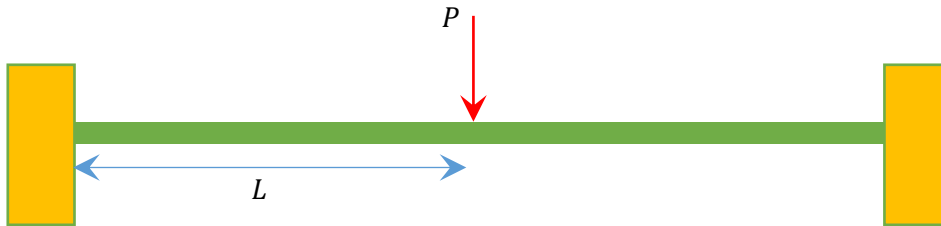


Figure 1: A beam subject to a central point load P .

2. Use two beam elements to solve the problem of a beam of length $2L$ fixed at both ends subject to a distributed load p_0 N/m, as shown in Figure 2.

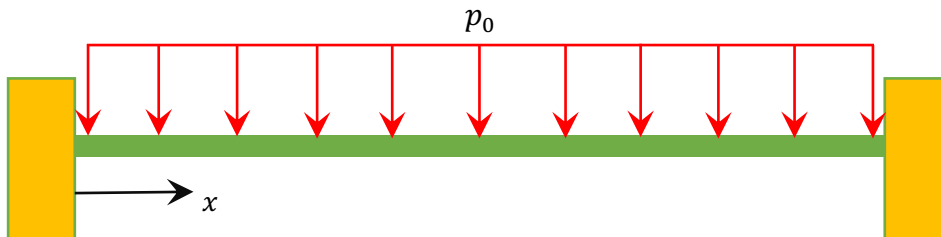


Figure 2: A beam subject to a uniformly distributed load p_0 .

3. Use two beam elements to solve the problem of a beam of length $2L$ fixed at both ends subject to a linearly distributed load $p(x)$ N/m, as shown in Figure 3.

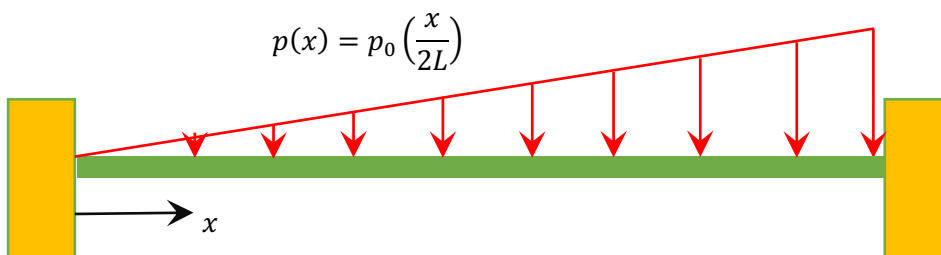


Figure 3: A beam subject to a linearly distributed load $p(x)$.

4. A framework formed from two frame elements, shown in Figure 4, is subjected to a horizontal point force P . The extensional stiffness of the elements is $k = EA/L$ and the bending stiffness is $\alpha = EI/L^3$. Formulate the matrices required to find the unknown displacements, forces and moments. Note: there is no need to solve the 3x3 matrices.

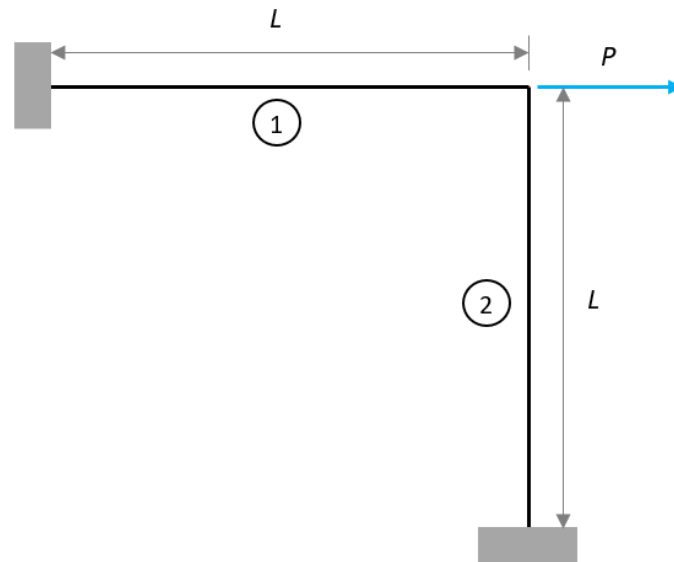


Figure 4: A framework formed from two frame elements