Thesis Title	Large Deflections Analysis of Variable-Arc-Length Beams via the Finite Element Method
Thesis Credits	12
Candidate	Miss Sunisa Rodsungwal
Supervisor	Prof. Dr. Somchai Chucheepsakul
Degree of Study	Master of Engineering
Department	Civil Engineering
Academic Year	1999

Abstract

This thesis deals with the large deflection analysis of variable-arc-length beams using the finite element method. Two main problems are considered. One is a continuous beam bent through different level of supports, and the other is a simple beam problem. For the continuous beam problem, the beam is hinged at one end while at the other supports the beam is free to slide over. The finite circular supports are also included in the continuous beam model formulation. For the simple beam problem, one end of the beam is hinged and elastically restrained against rotation while the other end is allowed to slide over a friction support. The location of supports are specified by Cartesian coordinates system. The distance between two end supports is the span length which is known, however the total arc-length of the beam is initially unknown. The beam can be subjected to the following loading conditions, (1) a point load at midspan, (2) bending moment applied at both ends in opposite direction, (3) bending moment applied at both ends in the same direction, (4) a uniform load along the arc –length, (5) a uniform load along the projection of beam on the horizontal axis, (6) the axial forces at the ends, (7) combination of these loading conditions. The equilibrium configurations of the beam under these loading conditions are to be determined. To solve the problem, an energy functional is formulated which involves the strain energy of beam and work done by the external forces. For stable equilibrium, the first variation of the functional is vanished. Since the problem is nonlinear, the finite element method and Newton-Raphson iterative process is used to solved it. The finite element discretization is made along the projection of the continuous beam on the

horizontal axis. The unknown displacement variable is determined by minimization of the energy functional. The numerical results are compared with these obtained from previous research work, they are found to be in good agreement.

Keywords : Continuous Beam / Equilibrium Configuration / Finite Element Method/ Frictionless/Large Deflection / Simple Beam /Variation Formulation