Thesis Title	Free Vibration Analysis of Inclined Elastic Arches
Thesis Credits	12
Candidate	Mr. Wasuroot Saetiew
Supervisor	Prof. Dr. Somchai Chucheepsakul
Degree of Study	Master of Engineering
Department	Civil Engineering
Academic Year	1999

Abstract

This thesis presents a finite element method for free vibration analysis of inclined elastic arches to determine natural frequency and mode shape. In the analysis, geometry of arch represented by the undeformed centroidal axis of cross section is defined by equation of plane curves such as circular, parabolic, sine, elliptic and catenary arc shapes in the rectangular coordinate system. In the free vibration state, the arch is slightly displaced from its undeformed position, the linear relationship between curvature-torsion, and axial strain are expressed in terms of the displacements in three dimensional space. In the finite element formulation, the displacements causing bending, torsion and axial deformations along its curved axis are approximated by cubic polynomials in terms of curve length parameter. By discretizing the arch along the span length, the global stiffness and mass matrices are formulated. The equation of motion for free vibration of the arch are derived from the Hamilton's principle. Eigenvalue problem is solved, and natural frequencies and mode shapes are determined.

This method is applicable for arches supported at the same or at the different levels. Furthermore, the analysis can be done for the other arches in which their shapes can be indentified by plane curves expressed in rectangular coordinates. Numerical results of arches of various shapes are given and they show good agreement with those reported in the literature.

Keywords : Finite Element / Free Vibration / Elastic Arch / Natural Frequency / Mode Shape