# The Natural Vibration of Pre-Twisted Beam under Rotating Conditions


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**ABSTRACT**

The natural vibrating behaviors of rotating beams with linear pre-twist angle along the length are studied in details using finite element analysis based on theory of three dimensional beam elements. Application of Hamilton ’ s principle of dynamics leads to equations of motion of an element, where the consistent mass matrix, the linear stiffness matrix, the inertial damping and stiffness matrices due to frame rotation, and the geometric stiffening stiffness matrix due to tension preload (here, centrifugal forces) are derived. A structural module for analysis of fundamental vibration is then developed to find the various vibrating modes of beams under rotating conditions. Various geometric parameters of the beams as well as a number of total pre-twist angles, beam root angles, beam rotating speeds, and radii of hub, are assumed so that effects of such parameters on the natural frequencies of the rotating beams may be realized.



Keywords : Pre-twisted angle ; Rotating beams ; Hamilton ’ s principle ; Natural frequency ; Tension preload


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