this study, the free vibration of the lead-lag motion of a rotating functionally graded beam (RFGB) is investigated. From Hamilton's principle, the linear partial differential equations are derived for coupled stretching and bending motion. The governing equations based on Euler–Bernoulli beam theory accounts for centrifugal forces field, the centripetal acceleration and the gyroscopic effect. A p-version of the finite element method in conjunction with the modeling dynamic method using the arc-length stretch deformation is applied to find natural frequencies and modes shape of the cantilever beam. The displacements are expressed as the combination of the in-plane and out-of-plane shape functions, enriched with trigonometric hierarchical shape functions used generally to give additional degrees of freedom (dof) to the interior of the element. The convergence properties of the rotating beam Fourier p-element is examined, the results are compared with those of the literature where excellent agreements are observed. The influence of angular speed, Young's modulus ratio and power-law exponent on the natural frequencies and mode shapes is investigated. The tuned rotating speeds at which the beam will vibrate violently are determined for stainless steel-silicon nitride RFGB versus the power-law exponent.

92 | Crack propagation effect at the interface of a composite beam

Hamli Bensahar, Hamid (University of Djilali Bounaama, Khemis Miliana, Algeria)
Hammoudi, Imène (University of Sciences and Technology Houari Boumediene, Algeria)
Chabaat, Mohamed (University of Sciences and Technology Houari Boumediene, Algeria)

In this research work, crack propagation at the interface of a composite beam is considered. The behavior of composite beams (CB) depends upon a law based on relationship between tangential or normal efforts with inelastic propagation. Throughout this study, composite beams are classified like composite beams with partial connection or sandwich beams of three layers. These structural systems are controlled by the same nature of differential equations regarding their behavior in the plane, as well as out-of-plane. Multi-layer elements with partial connection are typically met in the field of timber construction where the elements are assembled by joining. The formalism of the behavior in the plane and out-of-plane of these composite beams is obtained and their results concerning the engineering aspect or simple of interpretation are proposed for the case of composite beams made up of rectangular section and simply supported section. An apparent analytical peculiarity or paradox in the bending