



Library

Fiche Technique de Thèse de Doctorat

Titre de la thèse	Détection d'endommagement dans les structures en composite par analyse vibratoire / Damage Detection in Composite Structures Using Vibration Analysis
Filière et spécialité	Génie Mécanique / Ingénierie Mécanique
Doctorant	HASSAINE Narimane
Directeur de thèse	Pr. TOUAT Nouredine
Co-encadrant	Dr.DAHAK Mustapha
Date de soutenance	29.10.2025
Langue de rédaction	Anglais
Résumé	This thesis examines the effect of transverse cracks on the natural frequencies of Euler–Bernoulli functionally graded beams. Case studies are conducted to evaluate the influence of the power-law index, crack depth, and crack location under various boundary conditions, highlighting the superior performance of bidirectional functionally graded (FG) beams compared with homogeneous metallic and unidirectional FG beams. Metal and ceramic FG beams are analyzed using the h-version Finite Element Method (h-FEM), in which the stiffness reduction in cracked elements is modeled through local decreases in cross-sectional area. Furthermore, a frequency-based damage indicator is proposed for crack detection, and damage quantification is performed using an Improved Artificial Neural Network optimized by the Arithmetic Optimization Algorithm (IANN-AOA). The results demonstrate strong potential for accurate prediction of structural damage.
Mots-clés	FGM beam, natural frequency, finite element method, damage detection, neural network method, Improved ANN-AOA.