[15] Eltaher, M.A., Emam, S.A., Mahmoud, F.F. (2013). Static and stability analysis of nonlocal functionally graded nanobeams. Composite Structures, 96: 82-88. http://dx.doi.org/10.1016/j.compstruct.2012.09.030
[16] Ebrahimi, F., Barati, M.R. (2017). Hygrothermal effects on vibration characteristics of viscoelastic FG nanobeams based on nonlocal strain gradient theory. Composite Structures, 159: 433-444. http://dx.doi.org/10.1016/j.compstruct.2016.09.092
[17] Elmeiche, A., Bouamama, M., Megueni, A. (2018). Dynamic analysis of FGM nanobeams under moving load considering shear deformation effect. International Journal of Scientific & Engineering Research, 9(3): 1212-1221.
[18] Rahmani, O., Pedram, O. (2014). Analysis and modeling the size effect on vibration of functionally graded nanobeams based on nonlocal Timoshenko beam theory. International Journal of Engineering Science, 77: 55-70. http://dx.doi.org/10.1016/j.ijengsci.2013.12.003
[19] Sorrentino, S., Marchesiello, S., Piombo, B.A.D. (2003). A new analytical technique for vibration analysis of non-proportionally damped beams. Journal of Sound and Vibration, 265(4): 765-782. http://dx.doi.org/10.1016/S0022-460X(02)01560-2
[20] Dohnal, F., Ecker, H., Springer, H. (2008). Enhanced damping of a cantilever beam by axial parametric excitation. Archive of Applied Mechanics, 78(12): 935-947. http://dx.doi.org/10.1007/s00419-008-0202-0
[21] Robu, B., Baudouin, L., Prieur, C. (2011). Contrôle actif des vibrations dans un système fluide/structure. Journal Européen des Systèmes Automatisés (JESA), 45(7): 495-511. http://dx.doi.org/10.3166/jesa.45.495-511
[22] Chang, T.P., Chang, F.I., Liu, M.F. (2001). On the eigenvalues of a viscously damped simple beam carrying point masses and springs. Journal of Sound Vibration, 240: 769-778. https://doi.org/10.1006/jsvi.2000.3186
[23] Lin, S.M., Lee, J.F., Lee, S.Y., Wang, W.R. (2006). Prediction of vibration of rotating damped beams with arbitrary pretwist. International journal of mechanical sciences, 48(12): 1494-1504. https://doi.org/10.1016/j.ijmecsci.2006.05.015
[24] Chen, W.R. (2011). Bending vibration of axially loaded Timoshenko beams with locally distributed Kelvin–Voigt damping. Journal of Sound and Vibration, 330(13): 3040-3056. https://doi.org/10.1016/j.jsv.2011.01.015
[25] Bendine, K., Satla, Z., Boukhoulda, F.B., Nouari, M. (2018). Active Vibration damping of Smart composite beams based on system identification technique. Curved and Layered Structures, 5(1): 43-48. http://dx.doi.org/10.1515/cls-2018-0004
[26] Capsoni, A., Viganò, G.M., Bani-Hani, K. (2013). On damping effects in Timoshenko beams. International Journal of Mechanical Sciences, 73: 27-39. http://dx.doi.org/10.1016/j.ijmecsci.2013.04.001
[27] Van de Vegte, J., de Silva, C.W. (1976). Design of passive vibration controls for internally damped beams by modal control techniques. Journal of Sound and Vibration, 45(3): 417-425. https://doi.org/10.1016/0022-460X(76)90396-5
[28] Tsai, T.C., Tsau, J.H., Chen, C.S. (2009). Vibration analysis of a beam with partially distributed internal viscous damping. International Journal of Mechanical Sciences, 51(11-12): 907-914. https://doi.org/10.1016/j.ijmecsci.2009.09.039
[29] Chi, S.H., Chung, Y.L. (2006). Mechanical behavior of functionally graded material plates under transverse load—Part I: Analysis. International Journal of Solids and Structures, 43(13): 3657-3674. https://doi.org/10.1016/j.ijsolstr.2005.04.011
[30] Bao, G., Wang, L. (1995). Multiple cracking in functionally graded ceramic/metal coatings. International Journal of Solids and Structures, 32(19): 2853-2871. https://doi.org/10.1016/0020-7683(94)00267-Z
[31] Nguyen, T.K., Nguyen, T.T.P., Vo, T.P., Thai, H.T. (2015). Vibration and buckling analysis of functionally graded sandwich beams by a new higher-order shear deformation theory. Composites Part B: Engineering, 76: 273-285. https://doi.org/10.1016/j.compositesb.2015.02.032

NOMENCLATURE

L	Total Length of beam, m
h	Thickness of the beam, m
b	Width of beam, m
ℓ	Elementary length of the beam
p	Power index
E	Young's module, Gpa
$[M_e]$	Elementary mass matrix
$[C_e]$	Elementary damping matrix
$[K_e]$	Elementary matrix of stiffness
I_1, I_2	Function of the volume fraction
$\mathcal{R}$	Rayleigh dissipation function
T	Kinetic energy
V	Potential Energy
[Q]	The Hookean elasticity tensor

Greek symbols

$\{\sigma^T\}$	Total stress tensors
$\{\sigma^c\}$	Bending and shear classical stress
$\{\sigma^d\}$	Bending and shear dissipative additional stress
$\{\varepsilon\}$	The strain tensor
$\{\dot{\varepsilon}\}$	The strain rate tensor
β	Global viscous internal damping coefficient
ρ	Mass density, Kg.m^{-3}
κ	The shear correction factor of the Timoshenko beam theory
u	Displacement along the X axis
Θ	Rotation along the X axis
ν	Poisson coefficient
ω	Eignfrequency of the FGM beam
$\omega_{N,1}$	Unamortized natural frequency
ζ_1	The modal damping factor
$\omega_{d,1}$	The damped natural frequency
$\mathscr{L}$	Lagrangian fonction