World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:17, No:06, 2023

Dynamic Analysis of Nanosize FG Rectangular Plates Based on Simple Nonlocal Quasi 3D HSDT

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Abstract : In the present work, the dynamic analysis of the functionally graded rectangular nanoplates is studied. The theory of nonlocal elasticity based on the quasi 3D high shear deformation theory (quasi 3D HSDT) has been employed to determine the natural frequencies of the nanosized FG plate. In HSDT, a cubic function is employed in terms of thickness coordinates to introduce the influence of transverse shear deformation and stretching thickness. The theory of nonlocal elasticity is utilized to examine the impact of the small scale on the natural frequency of the FG rectangular nanoplate. The equations of motion are deduced by implementing Hamilton's principle. To demonstrate the accuracy of the proposed method, the calculated results in specific cases are compared and examined with available results in the literature, and a good agreement is observed. Finally, the influence of the various parameters, such as the nonlocal coefficient, the material indexes, the aspect ratio, and the thickness-to-length ratio, on the dynamic properties of the FG nanoplates is illustrated and discussed in detail.

Keywords : nonlocal elasticity theory, FG nanoplate, free vibration, refined theory, elastic foundation
Conference Title : ICCEN 2023 : International Conference on Civil Engineering and Nanotechnology
Conference Location : Venice, Italy
Conference Dates : June 15-16, 2023