The behaviour of thin composite plates with extension-bending coupling under harmonic compressive load

Tomasz Kubiak, Mehdi Bohlooly Fotovat

The plates under analysis were subjected to in-plane compressive harmonic load. The equations of motions describing the plate's deflection in time were derived analytically considering classical plate theory employing the Galerkin method. The damping was also included. To check the correctness of obtained results using the proposed analytical-numerical the finite element method was employed. The numerical model was prepared, and the obtained from both methods results were compared. Different parameters describing harmonic load, i.e., the mean value and amplitude, were assumed. In all analyzed cases, the mean value of harmonic load had the compressive character and was in the range from 0 to critical static buckling load. The amplitudes were assumed in such a way that the maximal load could be even higher than the buckling static load or/and the minimal load value could have the tension character. The plate's behavior was analyzed based on phase portraits and Poincare maps, assessing if they have periodic or chaotic behavior. The obtained results show different behavior of such a plate depending on the amplitude and mean value of harmonic excitation load. It could mean that such structures with proper dimensions could be used in microelectromechanical systems (MEMS) as sensors that generate energy and give different signals depending on excitation load parameters. The talk is continuation of research presented in [1], [2] and [3].

References

[1] Fotovat M.B.; Kubiak T.; Perlikowski P., *Mixed mode nonlinear response of rectangular plates under static and dynamic compression*. Thin-Walled Structures, 184, 2023, 110542

[2] Kubiak T.; Fotovat M.B., *Dynamic response and dynamic buckling of general laminated plates: A semi-inverse method*. Composite Structures 324, 2023, 117548

[3] Fotovat M.B.; Kubiak T., *Non-bifurcation behavior of laminated composite plates under in-plane compression*. Bulletin of the Polish Academy od Science, Technical Science, 72(2), 2024, e148874

First Author: *Tomasz Kubiak*
Affiliation: *Department of Strength of Materials, Lodz University of Technology 90-537 Lodz, Poland*
e-mail: tomasz.kubiak@p.lodz.pl

First Author: *Mehdi Bohlooly Fotovat*
Affiliation: *Department of Strength of Materials, Lodz University of Technology 90-537 Lodz, Poland*
e-mail: mehdi.bohlooly-fotovat@p.lodz.pl