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FREE VIBRATION ANALYSIS OF CABLES USING ADOMIAN DECOMPOSITION METHOD

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In the last decades, Adomian Decomposition Method (ADM) has been employed for solving various differential equations. In this paper, ADM technique is applied to analyze free vibration of a uniform cable with various boundary conditions. At first, the frequency equation is analytically obtained and then ADM is used to calculate the natural frequencies and mode shapes. Using ADM, the governing differential equation becomes a recursive algebraic equation and boundary conditions become simple algebraic frequency equations which are suitable for parametric computation. Doing some simple mathematical operations, one can obtain any natural frequencies and mode shapes at the same time. Finally, a uniform cable with three different boundary conditions is analyzed to verify the accuracy and efficiency of the method. To illustrate the reliability and robustness of the procedure, obtained results are compared with the exact values as well.

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ECCENTRIC LATTICE TOWER RESPONSE TO HUMAN INDUCED DYNAMIC LOADS

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An excessive lateral vibration of the lightweight pedestrian bridges has initiated worldwide interest of the researchers in phenomenon known as the human and structure synchronization. Recently built slender sightseeing tower in Latvia experiences vibrations that are not connected with the wind induced one. The lattice steel tower is 36 m high, has low damping ratio and natural frequency of the structure is close to the natural frequency of the human pacing. This paper analyses experimentally measured response of the tower's structure to the excitation caused by the human movement upstairs and downstairs. The study compares the human walking ground reaction force harmonic frequencies with the frequencies of the tower at its maximum response. It is concluded that the human movement on the stairs generates significant longitudinal and transverse force components. Even a small number of tower's visitors

cause a low frequency torsional vibration combined with transverse displacements. In the case of eccentric structure of the tower where two of critical mode shapes from the first three are the torsional ones. The results illustrate the human and structure interaction must be considered when designing the slender and lightweight sightseeing tower ensure safe exploitation and acceptable comfort levels during the exploitation. In conclusion there is a necessity to define the coupling model and synthetic formulas in order to predict tower's sensitivity to the human movement. The given vibration acceleration limits of design guidelines are not applicable for the torsional vibrations and should be developed a new human comfort criteria. **Keywords:** human induced vibrations, steel sightseeing tower, synchronization.

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NONLINEAR VIBRATIONS OF FUNCTIONALLY GRADED CYLINDRICAL SHELLS: EFFECT OF COMPANION MODE PARTICIPATION

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In this paper, the effect of the companion mode participation on the nonlinear vibrations of functionally graded (FGM) cylindrical shells is analyzed. The Sanders-Koiter theory is applied to model the nonlinear dynamics of the system in the case of finite amplitude of vibration. The shell deformation is described in terms of longitudinal, circumferential and radial displacement fields. Simply supported boundary conditions are considered. The displacement fields are expanded by means of a double mixed series based on Chebyshev polynomials for the longitudinal variable and harmonic functions for the circumferential variable. Both driven and companion modes are considered. Numerical analyses are carried out in order to characterize the nonlinear response when the shell is subjected to an harmonic external load. A convergence analysis is carried out by considering a different number of axisymmetric and asymmetric modes. The present study is focused on modelling the nonlinear travelling-wave response of the shell in the circumferential direction with the companion mode participation.