NONLINEAR FREE VIBRATION OF CANTILIVER CYLINDRICAL SHELL

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The cylindrical shells are the elements of various engineering structures such as pipes, rickets, aircrafts. Frequently, such structures perform vibrations with amplitudes, which are commensurable with their thickness. Then, the structure straining is geometrically nonlinear. This presentation devotes to such vibrations analysis.

Thin cantilever cylindrical shells are considered. The shell imperfections are not taken into account. At the first stage of the research, the free linear vibrations are analyzed using the Rayleigh- Ritz method. The longitudinal, circumferential and radial shell displacements are expanded be means of double series using trial functions. As a result of the analysis, the eigenfrequencies and eigenmodes are calculated.

At the second stage of the research, the Donnell's nonlinear shallow shell theory is used for shell modeling. The expression of the potential shell energy is obtained by using the nonlinear strain-displacement relationship. In the nonlinear analysis the full expression for potential energy contains the terms up to the fourth order is used. The nonlinear dynamical system is obtained by using the Lagrange equation. For reduction the number of degrees of freedom the longitudinal and circumference displacements is considered quasi statically. The nonlinear free vibrations are calculated using the harmonic balance method. The nonlinear modes of cantilever cylindrical shell are calculated numerically. The backbone curves are investigated.

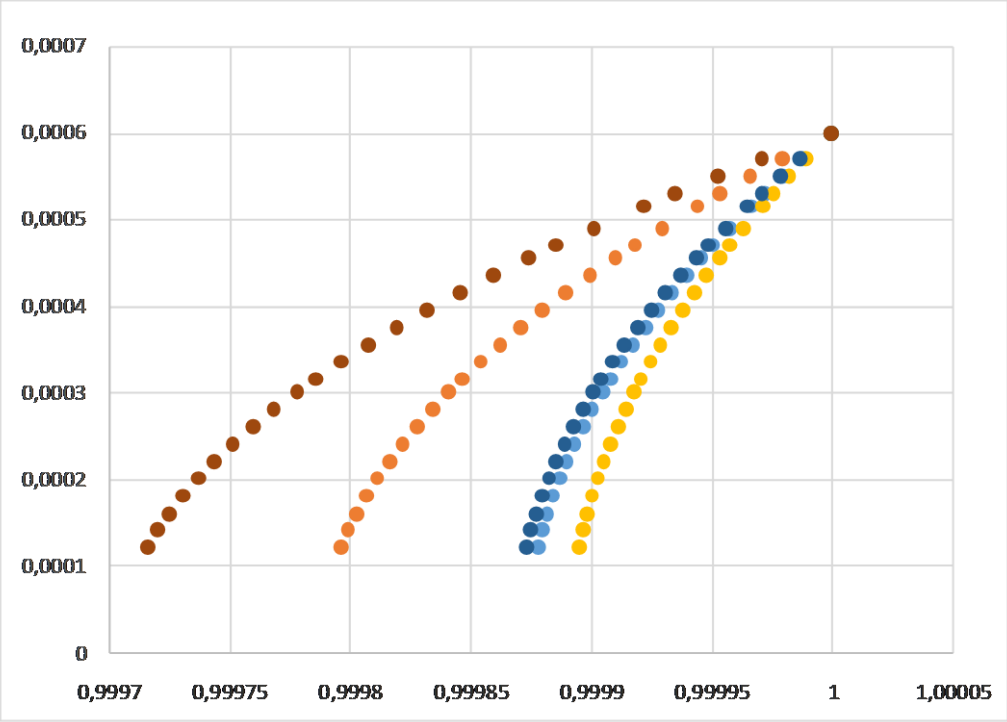

Fig 1-backbone curve