

where E is the Young's modulus, ν is the Poisson's ratio, R is the mean radius of cylindrical shell, l is the length and t represent its thickness.

The value of critical axial buckling load P_{cr} can be determined by giving values to external pressure and by minimizing P with regards to various values of m and n .

On the other hand, LBA can be used to predict the theoretical value for the buckling load that can be calculated by multiplying the load that was applied to the structure in static analysis phase P , with the load factor λ_{cr} given by computer program.

When combined actions, in static analysis phase, the structure is loaded with a compressive axial force having value P_{ax} and an external pressure q_{ext} . The program will provide a factor λ which multiplied by P_{ax} and q_{ext} leads to getting the critical values of the two loads acting simultaneously.

The goal of this research is to analyze the influence of external pressure on the stability of cylindrical shell under axial compression depending on its dimensional characteristics.

The studied models were represented by circular cylindrical shells of external radius $R_e = 1734$ mm, length $l = 1508$ mm, respectively 3016 mm and thickness $t = 3$ mm, respectively 4 mm, subjected to axial compression and external pressure. Material properties were: the Young's modulus $E = 2.1 \times 10^5$ and Poisson's ratio $\nu = 0.3$. The analytical and numerical results are presented in Fig. 1.

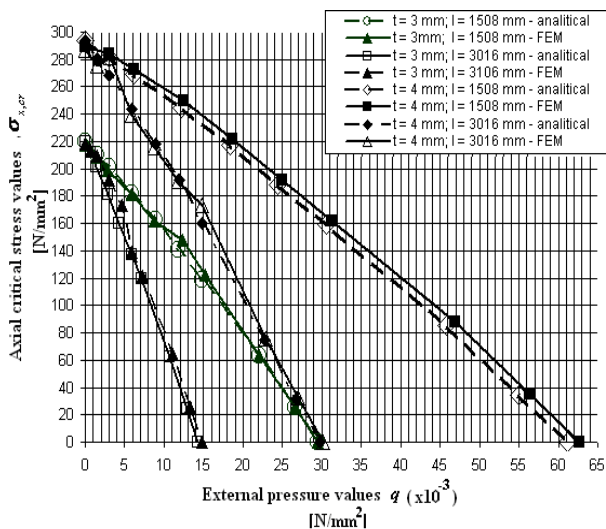


Fig. 1. Analytical and numerical results

Conclusions. The results presented in this article show that the presence of external pressure has the effect to decrease the critical axial buckling load. It can be seen, also, that an increase in the wall thickness of the cylindrical shell has the effect of extending the stable domain, while increasing its length makes this domain to be restricted.

The results obtained with the finite element method are very close to the analytical, which means that the use of the numerical method can lead to accurate information about the behavior of these structures when

subjected to combined actions. This thing is very useful, especially when studying complex structures such as stiffened cylindrical shells or shells with geometric imperfections, for which the analytical method is difficult to apply.

LITERATURE

1. Batdorf S. S., A simplified method of elastic stability analysis for thin cylindrical shells // National Advisory committee for aeronautics. Technical note N1341–Washington. – 1947.
2. Frank A., Larsen K., Methods for decreasing the total solution time of linear buckling finite element analyses. (Master's Thesis). Department of Mechanical & Manufacturing Engineering, Aalborg University, 2012.
3. Huang H., Han Q., Feng N. Buckling of Functionally Graded Cylindrical Shells under Combined Loads // Mech. Advanced Mater. Struct. – 2011. – v.18, N5. – P.337–346.
5. Prabu B., Rathinam N., Srinivasan R., Naarayan K.A.S., Finite element analysis of buckling of thin cylindrical shell subjected to uniform external pressure // J. Solid Mechanics. – 2009. – v. 1, N. 2. – P.148–158.
6. Timoshenko S., Gere J. Theory of elastic stability. Mc Graw-Hill Book Co., New York. – 1936.

SEMI-ANALYTICAL SOLUTION FOR POROUS FIN WITH TEMPERATURE-DEPENDENT HEAT TRANSFER COEFFICIENT AND EMISSIVITY

¹Shahbabaei M., ²Saedodin S., ³Ganji D.D.,
⁴Rahimipetroudi I.

¹Department of Mechanical Engineering, Azad University, Shirgah Branch, Iran

²Department of Mechanical Engineering, Semnan University, Semnan, Iran

³Department of Mechanical Engineering, Noshirvani University, Babol, Iran

⁴Department of Mechanical Engineering, Azad University, Sari Branch, Iran

In the present study, the problem of nonlinear equations arising in Spine Cylindrical Porous Fin with Temperature Dependent Heat transfer Coefficient and Emissivity is investigated. The Maxwell equations have been used, and also Rossel and approximation for radiation heat transfer and Darcy model for simulating the flow in porous medium have been adapted. The governing equations are reduced to a nonlinear ODE. The fin is supposed to be an insulated tip fin, which is exposed to a magnetic field. The Collocation Method (CM) is employed to compute an approximation to the solution of the system of nonlinear differential equations governing on the problem. It has been attempted to show the capabilities and wide-range applications of the CM in comparison with Homotopy Perturbation Method and numerical method namely Boundary Value Problem method (BVP) in solving this problems. The results reveal that CM is very effective and simple and can be applied for other nonlinear problems.