УДК 624.04:41

P. Mytrofanov, Ph.D., Associate Professor,
Phiri Risha (4 Course Student)
National University "Yuri Kondratyuk Poltava Polytechnic"

CALCULATING STABILITY OF THE FORM OF EQUILIBRIUM WITH "PERSIST" SOFTWARE

The thesis's presents the "Persist" software for calculating the stability of the equilibrium form of the first kind of compressed discrete systems by the displacements method. This method makes it possible to effectively determine the minimum critical stress or strain at the first bifurcation and their corresponding form of stability loss, both for statically determined and statically undetectable systems. The algorithm is implemented in the "Persist" software complex for a PC in OS Windows.

There are various methods for calculating the stability of the equilibrium form of discrete systems, due to the large volume of computations associated with the solution of the analytical condition for the loss of equilibrium stability. The solution of the analytical condition for the stability loss of the equilibrium of compressed discrete systems, which has high orders, and the definition of the critical load of the form of stability loss, is one of the topical problems. The problem solution is calculating the analytical condition for stability loss of the equilibrium of compressed discrete systems, which has high orders, and the determination of the corresponding critical load of the form of stability loss, generated a large number of methods by many mathematicians (Jacobi (iterations), Danilevsky, Krylov, Laverier [1 – 5]). The calculation of the compressed discrete system on the stability of the equilibrium form actually reduces to the solution of the difficultly described nonlinear transcendental equation, which is the equation of stability loss. The difficulty lies in the absence of analytical solution of such equation due to the presence of complex Zhukovsky functions, which in their structure have transcendental functions. Such solution can be performed only with the use of numerical methods. The purpose of the work is to develop an algorithm and software for the PC in Windows OS, which will enable students and engineers to automate calculations of stability of equilibrium forms of compressed discrete systems.

Fig. 1. Description parameters of the compressed rods

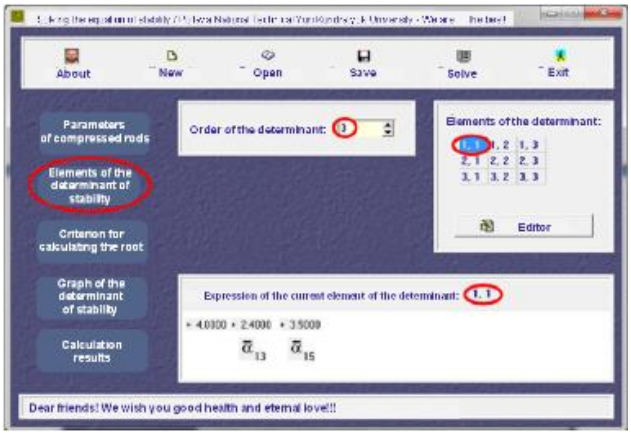

Fig. 2. Equation elements of stability loss of the equilibrium form

The algorithm and "Persist" software for PC in OS Windows are developed and implemented at the Department of Structural Constructions of the National University “Yuri Kondratyuk Poltava Polytechnic”. It will enable students and engineers to automate calculations of the stability of the equilibrium form of compressed discrete systems, calculate critical loads (stresses) and determining the corresponding principal forms of oscillations. The program has been approbated and implemented in the educational process at the National University “Yuri Kondratyuk Poltava Polytechnic” during the training of specialists in engineering specialties.

References

1. *Shkurupiy O.A. Stiykist' formy rivnovahy ta dynamika dyskretnykh system: navchal'nyy posibnyk [Stability of equilibrium and dynamics of discrete systems: Tutorial]. – Poltava: PoltNTU, 2015. – 228 p.*

2. *Ray Hulse, Jack Cain Structural Mechanics, Palgrave, London, (1991), 294 p.*

3. *Smyrnov A.F., Aleksandrov A.V., Lashchenykov B.Ya., Shaposhnykov N.N. Stroitel'naya mekhanika. Dynamika i ustoichivost' sooruzheniy [Structural mechanics. Dynamics and stability of structures]. – Moscow: Stroyyzdat, 1984. – 415 p.*

4. *Friedel Hartmann, The Mathematical Foundation of Structural Mechanics, Springer, Berlin, Heidelberg, (1985), 371 p.*

5. *Keith D. Hjelmstad, Fundamentals of Structural Mechanics, Springer, Boston, MA, (2005), 480 p.*