Basis problem in the stability loss problem of the plate with a hole under uniaxial tension

Stanislava Voloshinova*†[1] and Alexey Rzhonsnitskiy[2]

[1]Higher School of Economics – Russia
[2]St. Petersburg State Institute of Technology – Russia

Abstract

This paper studies the question of techniques for solving the variational problem by the Ritz method, in particular the definition and influence of natural boundary conditions in the problem of stability loss of a thin plate with an circle/elliptic inclusion. We investigate whether the natural conditions for the free edge should be taken into account and how this affects the convergence of successive approximations to the answer of the problem. The paper also discusses the matrix approach in the calculation of the total energy and the reasoning behind the choice of basis.
In order to find the critical load at which the loss of equilibrium (escape from the plane form) of a plate with a hole or an insert in tension occurs, it is necessary to solve the variational problem. And if in the case of a circle it can be done without using some tricks, in the case of complicating the geometry of the cutout or insertion, the cumbersomeness of the calculations increases significantly, and the accuracy obtained is questionable. This paper studies the question of techniques for solving the variational problem by the Ritz method, in particular the determination and influence of natural boundary conditions in the problem of stability loss of a thin plate with an elliptic insertion. We investigate whether the natural conditions for the free edge should be taken into account and how this affects the convergence of successive approximations to the answer of the problem. The paper also discusses the matrix approach to the calculation of the total energy and discusses the choice of basis.

The research was supported by the Russian Science Foundation (project no. 25-21-00202).

*Speaker
†Corresponding author: Kastasya@yandex.ru