8th International Eurasian Conference on Mathematical Sciences and Applications (IECMSA-2019), August 27-30, 2019, Baku, Azerbaijan

MODELING DEFORMATION, BUCKLING AND POST-BUCKLING OF THIN PLATES AND SHELLS WITH DEFECTS UNDER TENSION

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Abstract. Thin-walled elements are widely used in various designs. When analyzing their bearing capacity, it is necessary to take into account not only the loads leading to their destruction, but also the loads under which occurs the loss of stability. It should be noted that the stability loss can occur both during compression of these elements, and during stretching in the presence of defects such as cuts and inclusions in them, since in the vicinity of these defects there are areas of compressive stresses, which can lead to local buckling .

The problem of the loss of the plane form of deformation of the plate, weakened by a crack, under uniaxial tension was studied in a number of papers ([1] - [5]).

However, the question of post-buckling deformation and its effect on fracture did not receive a final answer. In this regard, we can point to the work [5], in which the experimental results for stretching paper sheets with a central crack were presented and it was stated that after the plate buckling the stress intensity decreases in the vicinity of the crack tip. At the same time, experiments on stretching of metal sheets with a central crack show that local buckling in the vicinity of the crack leads to an increase in the stress concentration in the vicinity of the crack tips, i.e. to reduce the fracture load [4].

In the framework of this article the post-buckling deformation of a plates and cylindrical shells with defects (cracks, holes) is analyzed and the effect of buckling on stress concentration near these defects is estimated. For plates with cracks the stress state in the initial postcritical stage is investigated and the approximate analytical solution is suggested.

Keyword: finite elements method, plate, shell, buckling, crack, hole, stress concentration.
AMS 2010: 74K20, 74K25, 74G60.

Acknowledgements: This work is supported by Russian Science Foundation with project number 15-19-00182.

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