

LOCAL LOSS OF RECTILINEAR STATIC EQUILIBRIUM OF A PRESTRESSED FRAME UNDER GENERALIZED LOAD WITH A FORCE DIRECTED TOWARDS THE POLE

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The importance of structural stability analysis in engineering is growing with the drive to design increasingly slender and optimized systems. This article focuses on the local loss of the rectilinear static equilibrium [1] of a frame under a specific load. Taking into account prestressing [2] further complicates the stability issue by introducing a state of tension into the initial system, independent of the external load, but it is somewhat beneficial from the perspective of load-bearing capacity and serviceability.

The nature of the generalized load with a force directed towards the positive pole analyzed in this work, allows the problem to be formulated based on both static (minimum potential energy principle) and kinematic (Hamilton's principle) stability loss criteria. Due to the nonlinearity of the frame column, the small parameter method was used to solve the problem.

The aim of this work is to present an analytical and numerical methodology that allows for the determination of critical values of bifurcation loads and the stability modes for these complex mechanical systems. The presented results illustrate the influence of the geometric parameters on the ranges of local loss of rectilinear static equilibrium. The authors demonstrated that effect of prestressing on stability is not unequivocally positive. Research has shown that there is a certain range of prestressing within which it has a beneficial effect on the bifurcation load value, and therefore on the frame's stability.

References

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