RELIABILITY OF STEEL STRUCTURES IN COMPLIANCE WITH THE PRINCIPLES OF THE EN 1990
Theoretical and Experimental Studies, Part 2

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The steel structures design standard EC3 [1, 2] allows, for frame structures with compression members, to determine the load carrying capacity both by the stability solution with buckling length and by the geometrically nonlinear solution with initial imperfection. On the example of two types of steel plane frames, it is demonstrated how the solutions presented result in different load carrying capacity values. The frame loading consist of both permanent active component and variable active component. Further on, the unbalance of failure probability in dependence on the relation of both loading components is analysed. A geometrically and physically nonlinear solution was applied to the probability analysis. The numerical simulation method Importance Sampling was used which made it possible to determine, with advantage, the failure probability even on a relatively low number of simulation runs. The input random quantities were considered both according to histograms determined experimentally [6], and by application of classical probability distribution types having parameters recommended in the corresponding specialized literature.

Key words: *reliability, simulation method, imperfections, yield strength, partial factor, buckling*

1. Introduction

In this contribution, we have linked up with the paper [12] verifying the values of material safety factor $\gamma_{M0} = 1.0$ for a tensile member. It has been verified whether statistical characteristics both of yield stress and geometrical quantities of steel products made by a dominant Czech producer are convenient. The standard case of a tensile member IPE270 was solved.

In the paper presented, we solve the reliability of a steel plane frame with slender columns under loading actions. If buckling is taken into consideration, the design reliability is guaranteed, to the standard extent, by safety factor $\gamma_{M1} = 1.1$. The problem will be discussed whether the partial reliability factors and procedures to determine the loading effects according to the EN 1990 Standard ensure a reliable design of a steel frame with columns under axial forces. Our research will issue from recent available materials [1, 2] (further on, EC3), reflecting the contemporary development situation in the branch of standard prescriptions.

The statistical characteristics found during the long-term experimental research will be used as significant input data, see [6]. For the input random quantities the statistical characteristics of which were not determined in any experimental way, classical distribution types and data recommended in specialized literature were applied.

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