Random fields of initial out of straightness leading to column buckling

The elastic load-carrying capacity and buckling trajectory of steel columns under compression with open and hollow cross-sections, whose axis is curved by spatial random fields, are studied in the article. As a result of the spatial curvature of the axis the cross-sections are subjected to compression, bending and torsion from the onset of loading. Numerical simulations are performed using the geometrically non-linear model created using the ANSYS software package. Each simulation run has input random realizations of yield strength and the random field generated using the Latin Hypercube Sampling method. In the plane perpendicular to a perfectly straight column axis, the random observations of deformation trajectories of a node in the middle of the column height are studied. The increasing compression load moves the node along the curve path (open sections) or along the linear path (hollow sections). Large discrepancies in the deformation trajectories of open sections (curvilinear paths) and hollow sections (linear paths) were observed from the comparison of simulation runs. The average and design load-carrying capacities of compressed columns with open cross-sections are lower in comparison to columns with hollow cross-sections due to the lower efficiency of open cross-sections in torsion.

General information
Publication status: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering, Brno University of Technology
Contributors: Kala, Z., Valeš, J., Jönsson, J.
Number of pages: 12
Pages: 902-913
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Civil Engineering and Management
Volume: 23
Issue number: 7
ISSN (Print): 1392-3730
Ratings:
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.86 SJR 0.572 SNIP 1.072
Web of Science (2017): Impact factor 1.66
Web of Science (2017): Indexed yes
Original language: English
Keywords: Steel structure, Imperfections, Column, Stability, Torsional buckling, Torsional-flexural buckling, Random field, Reliability
DOIs:
10.3846/13923730.2017.1341957
Source: FindIt
Source ID: 2372457474
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review