NATIONAL TECHNICAL UNIVERSITY OF ATHENS
SCHOOL OF CIVIL ENGINEERING
LABORATORY OF STEEL STRUCTURES

NON LINEAR ANALYSIS OF STEEL STRUCTURES USING STOCHASTIC PROCESSES

MASTER THESIS OF
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Analysis and design of earthquake resistant structures
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Abstract

Uncertainty quantification and methods used to measure the incertitude of the systems/structures have been upgraded in the last decades and many more, engineers take it into account for the analysis and design. With the view to including all the uncertainty factors that can cause damage to structures, without being considered into deterministic solutions, stochastic methods have been developed over the years. As a matter of fact, the Monte-Carlo simulation is the most well-known technique in the field of stochastic analysis. Nonetheless, this method needs a large number of random samples and as a consequence the computational cost can be rather high. This thesis presents the application of the Monte-Carlo simulation for exacting useful information so as to find the distribution of inelastic/elastic buckling load of the structures/systems respectively.

The first application is the Mindlin-Reissner plate in which, the Monte-Carlo simulation is applied in order to create distribution of buckling load of the system considering two stochastic fields not only for the Young's modulus but also thickness. In addition, further investigation is made for four different boundary conditions of the steel plate by plotting the different distributions together. In the second and last application, the Monte-Carlo simulation is applied in a 2D and 3D structure respectively so as to exact the distribution of the max base shear and top displacement considering material and geometric nonlinearity.

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