

Sensitivity analysis of truss and frame structures with uncertain geometry

Alfredo Rivera,
Department of Civil Engineering
The University of Texas at El Paso
arivera8@miners.utep.edu

Andrzej Pownuk
Department of Mathematical Sciences
The University of Texas at El Paso
<http://andrzej.pownuk.com>
ampownuk@utep.edu

Abstract

Behaviour of single bar in the truss structure can be described by the following second order differential equation

$$\frac{d}{dx} \left(EA \frac{du}{dx} \right) + n = 0, \quad \text{where } x \in [0, L] \quad (1)$$

In this paper the authors are discussing sensitivity of the internal forces and displacement of the truss structures with respect to the changes of the geometry of the structure. Results can be applied to the calculation of the reliability and in the optimization. Sensitivity of the solution can be calculated by using semianalytical methods, functional derivative, topological derivative or by using classical theory of sensitivity analysis. In order to take into account variation of the length of the bars it is necessary to consider initial strains. Similar theory can be applied in the case of frame structures and more complicated problems of computational mechanics.