A Comparative Study of Two Solution Strategies for NLFEA of Concrete Structures

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ABSTRACT
In order to exploit the full potential of non-linear finite element analyses (NLFEA) during design of concrete structures, a proper solution strategy needs to be established together with a suitable safety format. The solution strategy should comprise choices regarding compatibility, equilibrium and constitutive relations for both concrete and reinforcement, and should be proven to produce reliable results with sufficient accuracy without the need for major adjustments along the way. In this paper, two solution strategies are compared through benchmark analyses of a pre-stressed T-beam reported in the literature. The first solution strategy is based on the recently published guidelines for NLFEA, and the second is an engineering solution strategy based on a fully triaxial, empirically based material model for concrete recognizing the increased capacity due to triaxial compression and the inevitable increased lateral expansion when approaching failure in compression. Despite the simplicity of the engineering solution strategy, the presented results show that the two solution strategies are able to produce results with accuracy in the same order of magnitude.

Key words: Reinforced Concrete, Modelling, Non-linear Finite Element Analysis, Structural Design.