
Study of the non linear behaviour of concrete structures

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Summary

Running complete non linear analysis in concrete structure requires still some thinking. Which properties of the concrete and the reinforcement steel should be used for the analysis? This question is more likely problematic for the concrete for which the uncertainties on the material strength are higher than for the reinforcement steel. Several approaches using different material properties exist in the literature and are here investigated and compared. The approaches of the partial safety factor (using design properties) and of the global resistance factor (using modified mean properties) appear to be correlated and nearly similar. In contrast, real benefits that can reach 20 % of extra load margin compared to the two first, can be done using the estimation of the coefficient of variation approach.

In addition, where do we have to put the uncertainties safety factors on the model of actions and resistances in the verification process? Depending of the type of structure, the position of these safety factors can be argued and discussed. Indeed, for a non linear analysis, the relation between the force and the displacement is by definition non linear. The position of the safety factors (on the load or on the displacement) has then an importance and depends on the behaviour of the structure (under or over-proportional). For each approach, different relations are then proposed in function of the position of these factors of uncertainties.

The different relations of each approaches are here studied thanks to different numerical models. Models on cubes, columns, frames and beams with the catenary effect are made in this work using the non linear analysis software Finelg.