Non linear probabilistic analysis of reinforced concrete structures

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Summary

The behaviour of reinforced concrete bridges is doted of uncertainty as main parameters, like the ones related to material properties, are variable and not deterministic. In order to take this into consideration, a non linear probabilistic analysis should be developed. This paper presents an application of it on the evaluation of the structural behaviour of two batches of reinforced concrete beams, which were loaded, in laboratory, up to failure. However, when performing it, a previous attention must be paid to the intervenient parameters. In fact, on the one hand it is important to consider the highest number of parameters as possible but, on the other hand, this implies higher computational costs. In order to avoid this, it is essential to identify, by developing a sensitivity analysis, all critical parameters. A comparison of numerical results with obtained experimental data is executed, being, the advantages of such kind of analysis, pointed out.

Keywords: reinforced concrete structures; structural behaviour; sensitivity analysis; uncertainty; non linear probabilistic analysis.

1. Introduction

When evaluating the behaviour of a reinforced concrete structures it is, in many situations, desirable to develop a non linear numerical analysis, due to the non linearity of the behaviour of existent materials. On other way, and in order to consider the uncertainty of main parameters, probabilistic techniques should be also introduced on such kind of analysis, leading so to a non linear probabilistic analysis. Examples of this kind of analysis can be seen in [1, 2, 3]. In this paper the executed probabilistic non linear analyses, are realized using SARA platform, which is a combination of the software ATENA (non linear structural analysis software) [4] and FREET (reliability analysis software) [5, 6, 7].

Such analyzes falls upon the evaluation of the behaviour of two batches of reinforced concrete beams, tested, in laboratory, up to failure. A deterministic numerical model is firstly developed, calibrated and simplified. A sensitivity analysis, in order to identify critical parameters, is then executed. Afterwards, and once identified the probabilistic density function and the correlation coefficients of those parameters, a full probabilistic analysis is developed. From such analysis, the probabilistic density function of each output parameter is obtained. In other way, experimental data was grouped by beam typologies and characterized by a random density function. An index, which characterizes, in a more rigorous way, the approximation between both curves, is then defined.

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