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This study describes a novel methodology within the Global Resistance Format (GRF) to assess the design value of the global structural resistance of reinforced concrete (RC) structures as a function of the peak reinforcement strain (i.e., $\varepsilon_{s,max}$). Several experimental tests on RC structural members have been selected from the literature (Leonhardt and Walther, 1966; Lefas and Kotsovos, 1990; Filho, 1995; Foster and Gilbert, 1998) and numerically

reproduced by means of non-linear numerical analyses (NLNAs) (Figure 1).

Then, considering the mechanical (JCSS, uncertainties 2001), a probabilistic analysis of 30 NLN simulations for each RC structure is to characterize developed the probabilistic distribution of the global structural resistance. For the concrete, a coefficient of variation (CoV) equal to $V_c=0.15$ has been assumed, whereas the CoV of the reinforcement steel equal to $V_s = 0.05$. Therefore, for each RC system, the mean value and CoV $(V_{R,m})$ of the global structural resistance have been Successively, computed. these statistics have been correlated with the ratio between the peak and



Figure 1 – RC members: comparison between experimental and NLNA results (a, c);

yielding strain (i.e., $\varepsilon_{s,max}/\varepsilon_y$) in the reinforcement (Fig. 2a).

representation of the failure mechanism in concomitance of failure (b, d).



- b) Legend:
 - Leonhardt and Walther (1966)
 - ▲ Foster and Gilber (1998)
 - Filho (1995)
 - Lefas and Kotsovos (1990)

Expression for $V_{R,m}^{*_1}$:

 $V_{R,m} = V_c \cdot \left(\frac{\varepsilon_{s,\max}}{c} + 1\right)^r$ with $V_y \leq V_{R,m} \leq V_c$

 $\varepsilon_{s,max}$ peak strain attained in the primary reinforcement within NLNA performed using experimental values of materials and geometrical properties

 ε_y experimental value of the primary reinforcement yielding strength

*1 The values for the estimated parameter η corresponding to the best-fitting as well as the related lower and upper bounds of the 95% confidence interval are reported in the pictures.

Figure 2 – CoV of the global resistance $V_{R,m}$ as a function of the strain ratio $\varepsilon_{s,max}/\varepsilon_y$ for a concrete with $V_c=0.15$.

For each RC system, the peak strain the in reinforcement derives from a NLNA having the mean values as input data for the material properties. In this way, a predictive expression (Figure 2b) has been proposed to define the CoV the global of structural resistance as a function of reinforcement the peak This strain. proposal İS finalized safety to assessment.

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