Global Resistance Factors for non-Linear Analysis of Reinforced Concrete Structures

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The design value of a structural resistance can be determined directly from the mean value of the resistance using an appropriate global resistance (safety) factor. Probabilistic methods of the theory of structural reliability are applied to verify reliability of reinforced concrete members designed using the safety formats provided in the new *fib* Model Code – global safety factor method and method of estimate of coefficient of variation of resistance (ECOV). In numerical studies reliability of structural members exposed to bending, shear and compression is analysed. In addition the global factors are derived by probabilistic methods to achieve the target reliability level according to EN 1990 for basis of structural design.

It appears that the global resistance factors may depend on the type of concrete members, their reinforcement ratio and considered model uncertainties. In common cases (reliability index 3.8) the following global resistance factors related to mean values of basic variables may be considered: 1.4 for beams exposed to bending and 1.7 for beams exposed to shear and centrically loaded columns. The global safety method given in the Model Code, based on the mean yield strength of reinforcement and reduced value of concrete strength, hardly leads to a balanced reliability level for members subjected to different load effects. The recommended value 1.27 is in most cases conservative, but for lightly reinforced members may not yield an adequate reliability level. The ECOV method, based on the assumption of lognormally distributed resistance, leads to similar results as obtained by the probabilistic method. Further research should be primarily devoted to establishing uncertainties related to applications of finite element models including user and model factors as well as uncertainties of additional parameters of the models.

KEYWORDS

Global resistance factor, reliability, probabilistic methods.