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Application of Global Safety Formats from Model Code 2010 for Design and Structural Assessment by Nonlinear Analysis

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Several safety formats are proposed in Model Code 2010 for the verification of safety of resistance calculated by non-linear analysis. The paper summarizes the experience of the authors obtained in recent years in various projects involving the application of nonlinear finite element analysis and the new safety formats from Model Code 2010.

The methods of safety assessment applied in this investigation include: (1) Global resistant factor method; (2) Method of estimation of a coefficient of variation (ECOV method); (3) Full probabilistic analysis; (4) Partial factor method. In all methods the resistance is calculated by non-linear finite element method. However, the safety assessment is different in each method.

The paper will address the treatment of model uncertainties, which represents a crucial problem in reliability verifications of reinforced concrete structures by nonlinear analysis.

The performance of the individual methods will be compared on simple examples with shear, bending or compression failure with experimental results or with known analytical solution. The significant part of the paper will be devoted to the discussion of experiences obtained in the application of the presented safety formats to the practical engineering problems.

The presented examples will focus on advanced structures with high safety and reliability requirements, such as:

- the design of high strength concrete grout for offshore wind farm support structures
- design of tunnel linings from unreinforced or fibre reinforced concrete, and others.

The paper conclusions will discuss the advantages and disadvantages of the safety formats proposed in Model Code 2010 regarding their practical application and will highlight the significance of proper treatment of model uncertainties for their reliable application in practice.

References:

Červenka V. (2008). Global Safety Format for Nonlinear Calculation of Reinforced Concrete. Beton- und Stahlbetonbau 103 (2008), Special Edition, Ernst&Sohn. Pp37-42

Model Code 2010. First complete draft. Volume 1 - fib bulletin 55. Volume 2 - fib bulletin 56. ISSN 1562-3610. ISBN 978-2-88394-095-6. International Federation for Structural Concrete (fib), Lausanne, Switzerland. 2010.