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Investigations on the Design of Membrane Structures with the Semi-Probabilistic Safety Concept

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ABSTRACT

The semi-probabilistic safety concept was developed for limit state equations that are linear or mildly non-linear. EN 1990 (Eurocode 0) [1] provides simplified design rules in case of non-linear functional relations between actions and their effects, which are based on a distinction between under- and over-linear behaviour. We discuss circumstances in which this classification can be ambiguous and propose a modified, unambiguous classification. We apply the proposed modification to membrane structures, and discuss in particular the challenges of the classification due to pre-stressing of the membranes. We then show the effect of the classification on the reliability: The simplified classification of EN 1990 can lead to inconsistent reliability levels for structures with non-linear behaviour. Finally, we discuss the consequences of our investigations on the semi-probabilistic safety concept for non-linear structures such as membranes.

Keywords: architectural membranes, partial safety factors, non-linear behavior, semi-probabilistic safety concept, reliability analysis, Eurocode.

REFERENCES

- [1] Comité Européen de Normalisation (CEN), EN 1990: Eurocode: Basis of structural design (EN 1990:2002 + A1:2005 + A1:2005/AC:2010) . Brussels, 2002/2010.