FUZZY CONCEPT OF SERVICEABILITY LIMIT STATES

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ABSTRACT

Fuzzy concept of serviceability limit states of building structures takes into account common reality that suitability of a structure for normal use is not completely lost when its deformation (acceleration, crack width, etc.) exceeds certain limit value, but rather it gradually decreases with increasing deformation from top level to full disability. Thus, generally there is no crisp but more or less fuzzy definitions of functional requirements. The level of ability of a structure to comply with the functional requirements is described by membership function, known from the fuzzy set theory; in the range from one to zero it gives the level of support for the structure to be a member of the set of fully suitable structures.

Proposed definition for characteristic value of limit deformation is based on fundamental characteristics of appropriate membership function and on admissible cumulative damage of a structure. Furthermore, probabilistic analysis of functional requirements yield conditions for admissible statistical characteristics of structural deformations garanteeing sufficiently low fuzzy - probability of serviceability failure. Fuzzy set theory seems to be useful tool in solving various practical problems of serviceability limit states of building structures.