Application of fuzzy analysis in simulation of construction processes

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Abstract

Erecting a building is always a unique process. Reasons for this are for example external influences like the weather or the conditions at building site and its surrounding area, but also different construction methods and construction equipment. This entails that construction planning involves uncertainty; there are no deterministic values about for instance costs or duration of processes. Nevertheless planning often is based on deterministic values which can lead to unrealistic results. For aleatoric uncertainty methods of stochastics can be used. Therefore information about distribution of variability is required. In case of epistemic uncertainty, however, it is impossible to describe information exactly; there is no complete knowledge. For this purpose the fuzzy set theory is applicable whereby ranges like “delivery in about one week” can be modeled.

To increase planning certainty also in building industry it is useful to simulate at least critical construction stages before. To obtain realistic results uncertain input values should be integrated into simulations. In this paper only epistemic uncertainty or rather fuzziness is regarded. Consequently fuzzy analysis can be used to map fuzzy input variables onto fuzzy output variables. This represents an optimization problem which can be solved with the aid of α-level optimization after (MÖLLER & BEER, 2004). It is possible for example to figure out the minimum and maximum duration and the influence of the uncertainty. The paper outlines this approach by an example implemented prototypically in the simulation program AnyLogic.

Reference

Möller, B. & Beer, M. (2004): Fuzzy Randomness – Uncertainty in Civil Engineering and Computational Mechanics. Springer, Berlin [u. a.], 2004.