Value of Information by updating model uncertainties utilising proof loading in the context of series and Daniels systems

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In this paper, an approach is presented for the determination of the Value of Information (VoI) in relation to models which can represent structural systems such as e.g. towers, cables, jackets. Stochastic capacities and loads are assumed for the models studied herein. The VoI is obtained with a prior and a pre-posterior decision analysis. The prior decision analysis takes basis in the design phase of the structural system. Pre-posterior decision analysis builds upon modelling results of not yet conducted experiments. In order to perform the prior and pre-posterior Bayesian decision analysis, the expected life-cycle benefit of the considered systems are computed. The difference in the expected benefits relating to the prior and pre-posterior decision analysis leads to the VoI. The system models are probabilistically computed using the Monte Carlo / Importance sampling simulations to estimate their probability of failure. Next to the intrinsic uncertainties in loads and capacities further uncertainties accounting for the model uncertainties are included in the simulations. As an SHM strategy, proof loading is considered and modelled as a process accompanying the construction. The costs of proof loading and probable component failures are considered explicitly. The analyses results point to high Value of Information for component proof loading in systems with a low reliability.

General information
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Brüske, H., Thöns, S.
Pages: 52-61
Publication date: 2016

Host publication information
Title of host publication: International RILEM Conference on Materials, Systems and Structures in Civil Engineering 2016 : Segment on Reliability, Safety and Value of Information
Volume: Proceedings R-362
Publisher: Rilem publications
Editor: Thöns, S.
ISBN (Print): 9788778774552
Electronic versions:
Untitled_12.pdf
Source: PublicationPreSubmission
Source-ID: 128844043
Research output: Research - peer-review ; Article in proceedings – Annual report year: 2017