On the Value of Monitoring Information for the Structural Integrity and Risk Management - DTU Orbit (10/12/2018)

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This article introduces an approach and framework for the quantification of the value of structural health monitoring (SHM) in the context of the structural risk and integrity management for systems. The quantification of the value of SHM builds upon the Bayesian decision and utility theory, which facilitates the assessment of the value of information associated with SHM. The principal approach for the quantification of the value of SHM is formulated by modeling the fundamental decision of performing SHM or not in conjunction with their expected utilities. The expected utilities are calculated accounting for the probabilistic performance of a system in conjunction with the associated structural integrity and risk management actions throughout the life cycle, the associated benefits, structural risks, and costs and when performing SHM, the SHM information, their probabilistic outcomes, and costs. The calculation of the expected utilities necessitates a comprehensive and rigorous modeling, which is introduced close to the original formulations and for which analysis characteristics and simplifications are described and derived. The framework provides the basis for the optimization of the structural risk and integrity management based on utility gains including or excluding SHM and inspection information.
Studies of fatigue deteriorating structural systems and their characteristics (1) provide decision support for the performance of SHM, (2) explicate the influence of the structural component and system characteristics on the value of SHM, and (3) demonstrate how an integral optimization of SHM and inspection strategies for an efficient structural risk and integrity management can be performed.

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