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RISK-BASED DECISION MAKING FOR RESILIENT SYSTEMS

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Abstract. *Resilient systems present an inherent ability of recovering from a certain damage state reached due to the application of a significant stress. The quantification of a system's resilience is a difficult task to perform because of: a) the system's complexity, b) the uncertain characteristics of the excitation force, c) the lack of specific elements to measure for an accurate assessment of a system's resilience, and d) the lack of robust tools for quantifying a system's resilience. Therefore, a decision maker requires both a methodology and the tools to decide for the most effective risk-response strategy. This paper presents such a methodology for a risk-based decision making for resilient systems. The proposed methodology involves the consideration of the following parameters: i) the variability of impact upon risk occurrence, ii) the available response strategies, and iii) the preference of the decision maker with regard to the criticality of the various impacts upon risk occurrence. The proposed methodology considers the four risk-response strategies defined by the Project Management-Body of Knowledge (5th ed.), namely: a) acceptance, b) mitigation, c) transfer, and d) avoidance. Three criteria are examined, in order to determine the preference margins between these strategies: i) compliance with regulations and specifications, ii) determination based on data elaboration (e.g. statistical, empirical, etc.), and c) subjective judgment. By applying any one of these criteria for a specific risk impact, the decision maker predetermines the boundary values between the risk-response strategies. Once, the value of the impact upon risk occurrence is estimated, the decision maker is capable to decide for the respective risk-response. The proposed methodology, then, integrates the various strategies decided for the various risk impacts to one single strategy that best confronts simultaneously all the different impacts on the system. The application of the proposed methodology is demonstrated through a case study that provides with numerical results. This paper introduces a new approach that successfully incorporates into the risk-based decision making problem, the critical issue of considering margins between damage states of resilient systems for various failures that occur simultaneously under a single stress.*