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DECISION MAKING FOR PROBABILISTIC FATIGUE INSPECTION PLANNING BASED ON MULTI-OBJECTIVE OPTIMIZATION

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ABSTRACT

Probabilistic service life management of a deteriorating structure subjected to fatigue is a systemic process of assessing and predicting its structural performance, and establishing the optimum inspection and repair plans under uncertainty. In order to consider multiple objectives for optimum inspection and repair planning simultaneously, it is necessary to apply the multi-objective probabilistic optimization process (MOPOP) approach. In general, an increase in the number of objectives that requires probabilistic simulations for fatigue initiation and propagation results in high computational cost and difficulty in the visualization of Pareto optimal solutions and decision making to select the best solutions. Consequently, efficient decision making for multi-objective inspection planning of fatigue-sensitive structures is necessary. This paper deals with such a decision making framework for probabilistic fatigue inspection planning based on multi-objective optimization. The multiple objectives are converted into a single objective by using weights of the objectives, and as a result, a single optimum solution for inspection planning is obtained. The final decision making is performed by identifying the essential objectives and selecting the best Pareto optimal solution. Furthermore, the computational efficiency of the decision making and the effect of the uncertainties associated with fatigue crack initiation and propagation on the decision making for optimum inspection planning are investigated.

Keywords: decision making; fatigue crack; inspection planning; multi-objective optimization;

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