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# SHM Applications: Detection and Tracking of Damage in a Wing Attachment Fitting

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This paper demonstrates the ability to design health monitoring systems from a systematic perspective and, with proper sensor and actuator placement, to detect and track damage occurring in a structure. The results from the second of three separate tests are presented showing the daily progression of damage until ultimate failure of the part under test. The tests were performed and the data were collected to emulate on-ground health monitoring scenarios. The data indicate the precursors to total structural failure significantly before the failure occurs.

To achieve these results, a design optimization was performed to determine the best locations to excite the structure and to collect data while using the minimum number of sensors. The techniques used to design the monitoring system allow for any type of sensor (thermal, strain, electromagnetic, etc.) and can find the optimal locations with respect to defined objective functions (sensitivity, cost, etc.). They also account for modeling error and variations in boundary conditions. The use of model-based optimization techniques for the design of the monitoring system is driven by the desire to obtain the best performance possible from the system given what is known about the system prior to implementation. The use of a model is more systematic than human judgment and is able to take far more into account concerning the dynamical response of a system than even an experienced structural engineer.

**Ключевые слова:**

**Содержание.**

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