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”SHM#1 - From Lab to tail boom: the challenges to develop a SHM system in an industrial context”

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To prevent any accident, a schedule driven maintenance is mandatory to review the many critical parts of a helicopter. As a result, ratio of maintenance man hours to flight hours is often near 4. Despite the time of meticulous review, 14% of the accidents in the aeronautical industry are linked to maintenance issues or clumsiness. The global cost of maintenance is high due to the wasted time of inactivity, the human resources involved and the risk of over-damaging during disassembly. The transition to a condition-based maintenance requires a reliable monitoring system. For many years, new monitoring techniques have been developed to estimate the health of the structures and shorten maintenance time. The structures are monitored in place without any disassembly to limit handling accident. The rear transmission shafts of helicopters are critical and need to be monitored. A promising technique, the Gapped Smoothing Method (GSM), was developed by Ratcliffe and Bagaria in 1998 and allows to localize damages in beam-type structures. This paper points out the potential of the GSM to monitor helicopter shafts without the need a pristine shaft. The method is based on the modal response of the shaft. The modal curvature of the beam, computed from the measured displacements, is compared to the expected theoretical curvature. This value is compute from the beam vibration theory and is approximated with a third order polynomial. Results from this work are in agreement with those presented by Ratcliffe and Bagaria. This method was applied to a more representative structure of a rear drive shaft, differing from the original rectangular section beam. Different tests highlighted the limitations of the GSM which could not be observed in the case presented in the original article. New perspectives of research will be proposed to consider the use of the GSM in an industrial context.

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