



An experimental setup for subspace based damage identification methods

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Structural health monitoring is regarded as the main tool in assessing the functionality of existing structures [1]. The importance of the research on this technique becomes obvious by considering that failure of a structure can result in catastrophic loss. Existing civil structures deteriorate by aging and under different loading conditions imposed from natural phenomena.

Damage identification methods are the main component of structural health monitoring which process the data in order to isolate damages. Among these methods, subspace damage identification methods have a strong theoretical foundation [2]. This technique can detect the damage in a structure by creating a subspace from measurement data in a reference (healthy) state. This subspace is employed in a statistical comparison along with the data measured from the possibly damaged structure in assessing the condition of the structure. Following the detection, the second identification level is to locate the damage. In this framework, several subspace damage localization methods has been developed [3, 4, 5], based on the use of a finite element model.

An experimental setup is designed with objective to investigate major recent researches in the field of statistical subspace based methods. The structure consists of four aluminum rectangular hollow structural sections bolted together to their ends. Different damage scenarios can be assessed, as for example mass variations (by adding local masses along the structure) or stiffness variations (either by adjusting torque for the bolts or by pre-tensioning cables along the structure). In addition, temperature fluctuations can be taken into consideration. A wireless sensor platform PEGASE provides the link between accelerometers mounted on the structure and the data processing interface which gathers together all subspace identification methods.

The overarching goal of this setup is to reduce the gap between the theory and applications, in order to have a methodology with strong theoretical background and great functionality under real test conditions.

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