

ABSTRACT (inglese)

The here considered SHM procedure concerns innovative techniques for a structural monitoring of aeronautical components, all of them based upon the use of a Scanning Laser Doppler Vibrometer. The vibrometer is used to detect the dynamic response of the component under test, in wave propagation regime. The signal so recorded consists of space and time maps of vibration velocity offplane. The purpose of the study lies in the analysis of such maps, using filtering techniques that separate reflected waves from the incident ones, so that they can enable to identify defects. The innovative application of a novel technique (introduced by Ruzzene) for the first time to stringerized composite specimens, allowed the generation of baseline information directly from the measured dataset.

The effectiveness of these methods has been demonstrated through their application to detection of a delamination in a composite stiffened plate and detection of defect/wrinkling in a T-shaped skin to stringer component.

The most significant technological innovations achieved through these theses are:

- The option key to excite the surface of a complex structure (in this case, the skins of a composite stingerized panel) and to derive the velocity profile on surfaces orthogonal to the excited one (in our case the web of the stringer) has been checked.

This is crucial, as it would allow to install the piezo elements on the stringers, to excite them and to read velocities of points over the entire surface of the skin, without disassembly. Up to now, only cases of standard solicitation have been analyzed in literature, or cases where the velocities were acquired on the same surfaces excited. Today, therefore, there is no published study on the analysis conducted in such a manner.

- The damage index was also applied to stiffened and greatly complex geometries. Up to now, in literature only analysis applied to simple flat panels can be found.
- The FEM simulation was carried out on stiffened panels. In literature there are only simulations carried out on simple structural elements like flat panels without any stiffener.