

Application of a new optical measurement technique for non-intrusive wing deformation measurements on a large transport aircraft

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Abstract

The in-flight deformation of wings has a significant impact on the aerodynamic performance of an aircraft. Thus, it has to be measured. At the moment classical measurement techniques such as strain gauges or accelerometers are applied. These techniques give accurate results but have the drawback that they only provide local information. Furthermore, the installation of the sensors and their wiring could cause structural and aerodynamic interferences. To avoid these effects non-intrusive measurement methods are preferred. A photogrammetry method is already applied for these measurements, although the method has some constraints. At the moment only static measurements are provided and accuracy depends on careful and time-consuming calibrations.

Within the EC funded Specific Targeted Research Project AIM (Advanced In-flight Measurement techniques) a novel advanced non-intrusive measurement technique called IPCT (Image Pattern Correlation Technique) was tested for in-flight application to wing deformation measurements. Applying the Image Pattern Correlation Technique (IPCT) can improve the accuracy, reduce installation time, provide local surface deformations and give dynamic results. The IPCT is a special kind of DIC (Digital Image Correlation) and thus an optical, non-intrusive measurement technique. It is based on photogrammetry in combination with modern correlation algorithms developed for Particle Image Velocimetry (PIV). The technique was developed for in-flight applications by DLR and NLR. Within AIM the feasibility to apply the technique for an industrial flight test has been demonstrated on an Airbus A 380. In the presented paper the measurement technique, the installation on the A380 and the test performed in June 2009 will be described. At the end some of the first results of the test will be presented.