FANTOM PROJECT : ELECTRONIC SPECKLE PATTERN INTERFEROMETRY AT THERMAL INFRARED WAVELENGTHS, A NEW TECHNIQUE FOR COMBINING TEMPERATURE AND DISPLACEMENT MEASUREMENTS

Marc GEORGES, Cedric THIZY, Jean-François VANDENRIJT

Centre Spatial de Liège-Université de Liège, Liege Science Park, B-4031 Angleur, Belgium, mgeorges@ulg.ac.be, http://www.csl.ulg.ac.be

Igor ALEXEENKO, Giancarlo PEDRINI, Wolfgang OSTEN

Institut für Technische Optik, Universität Stuttgart, Pfaffenwaldring 9, 70569 Stuttgart, Germany
http://www.uni-stuttgart.de/ito/

Iagoba Jorge ALDAVE, Ion LOPEZ, Idurre SAEZ DE OCARIZ

Centro de Tecnologías Aeronauticas, Parque Tecnologico de Alava (Minano)C/Juan de la Cierva 1, Minano (Alava) 01510, Spain , http://www.ctaero.com

Birgit VOLLHEIM, Gunnar DAMMASS, Matthias KRAUSZ

InfraTec GmbH ,Gostrizter Strasse 61-63, 01217 Dresden, Germany, http://www.infratec.de

Abstract

The European Union funded FANTOM project aims at developing an innovative holographic technique for deformation measurement using lasers emitting in the around 10 µm wavelength and incorporating uncooled and cooled thermal imagers. This opens the way to a single sensor combining temperature and deformation measurements in simultaneous or quasi simultaneous acquisitions. In this paper we present the FANTOM project objectives, we describe the optical technique and discuss the way of decoupling both types of information. Then we show results obtained so far in the project in the range of thermo mechanical assessment of composite structures mainly with the aim of structural testing. Future perspectives in NDT are also briefly discussed.

Keywords Non Desctructive Inspection; Holography; Thermography.

1. Introduction

Non Destructive Inspection (NDI) is of great importance in different industrial sectors and for various applications: flaws detection in production or maintenance, assessment of structural behaviour of structures in development phase and structural testing, etc.

Optical NDI are of interest compared to others since they are contactless and generally full-field, avoiding time-consuming scanning the target with a pinpoint probe if one wishes a large number of measurement points.

The two main optical NDI techniques are thermography and holographic interferometry (incl. shearography). The first one consists in measurement of minute variations of local temperature at defects when the target is undergoing various types of excitations, such as flash lamps, modulated lamps or ultrasound (Maldague, 2000; Busse *et al,* 1992). Holographic interferometry (Kreis, 2005) is generally targeted to structural behaviour assessment since it basically consists of observation of full field displacement/deformation maps of targets undergoing various types of loads (thermal, mechanical incl. vibrations). Holography is known to be sensitive to external perturbations due to the fact that this method requires interference of two laser beams : one traveling to and returning from the object on one side (object beam) and a second one going directly to the holographic sensor on the other side (reference beam). The resulting microscopic interference pattern depends on the laser wavelength and must be stable during the recording. With visible lasers this induces stability constraints of a typical half of the wavelength; say around 250 nm, which is practically unfeasible in industrial environments. Various versions of Holographic Interferometry (HI) exist such as classical HI with photoplates, photorefractive