Double-pulsed holographic interferometry with photorefractive crystals

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We present the achievement of the european PHIFE project (Pulsed Holographic Interferometer for the analysis of Fast Events) and which consisted in the development of holographic head principles connected to a YAG Q-switch double pulsed laser. An industrial prototype has been built with the aim of full-field out-of-plane displacement measurement at a high repetition rate.
The development included the study of different crystals families (sillenites and semiconductors for, respectively, 532 nm and 1064 nm laser operation), different recording geometries (co-propagating and 90°) and diffraction properties (anisotropy of diffraction and beam coupling). In parallel, a new double pulse laser has been studied and built. Its specifications are a 25 Hz repetition rate, high energy (800 mJ/pulse in single pulse operation), variable delay between pulses (from 1 to 200 µs) and based on a single cavity instead of the usual 2-cavities scheme.
From these first studies, the best configuration has been selected to be incorporated in the industrial prototype. The latter includes both the new laser and a modular holographic head that allows to switch easilly between operations in the green or the infrared.
The prototype has been extensively used in variety of tests, mainly vibrations and shock analysis of solid objects proposed by industrial partners.
The prototype allows also the easy adaptation to the study of transparent objects, with the aim of measuring aerodynamic density variations in windtunels.
We will demonstrate the capability of the system by these examples. Real-time movies of high resolution interferograms have been obtained with the system and will be presented.