# Portable device for digital holographic interferometry

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**Objective: Development and research of a small device for digital holographic interferometry in the formation of a focused image on a digital camera**

A small device for the realization of the method of digital holographic interferometry has been developed. The dimensions of the device allow it to be used for research in unsuitable conditions, easy to transport, etc.

Digital holography (DH) has an important place in metrology for the study of deformations, displacements, surface relief and visualization of phase inhomogeneities. In digital holography, the first stage of obtaining a hologram on a photosensitive medium is the purely optical stage. Photosensitive arrays based on charge-coupled devices (CCD) are usually used as the recording medium. The next step is reproduction the original image of the researched object with computer simulation of the interaction of the conjugate reference beam with a digital hologram. The reproduced image is displayed on the screen. It is obvious that the principles of DH are used in digital holographic interferometry (DHI), in particular in the method of two exposures. The DHI compares two reconstructed phase fields of one object which are recorded after a certain time interval. The difference in phase distributions determines the phase map which contains phase jumps of π. The quantitative values of the measured values (displacement, deformation, vibration, etc. on the basis of the calculated phase picture), are obtained.

In this device, the lenses L1, L2 and L3 have the same focal length of 150 mm. Lenses L1 and L2 are designed for collimation of laser beams. At the same time, the lenses L1 and L3, as well as L2 and L3 perform Fourier transforms, reflected beams from the mirror 4 and the object under study 5 [1]. The focal length of the L4 lens is chosen so that a focused image of the subject is fully formed on the sensitive area of the digital camera. The angle of convergence between the two beams was determined from the condition that one interference band had at least 5 pixels, which follows from the theorem on samples. The spatial filter 6 is designed to limit the angular spectrum of light scattered (reflected) by the object 5. In our experiments, we used a semiconductor laser with a lasing wavelength of 650 nm, which has a sufficient coherence length to create a high-quality interference pattern. A small-sized semiconductor laser with enough power and needed coherence is used in the interferometer scheme. Fig. 1 shows the optical scheme of the device.

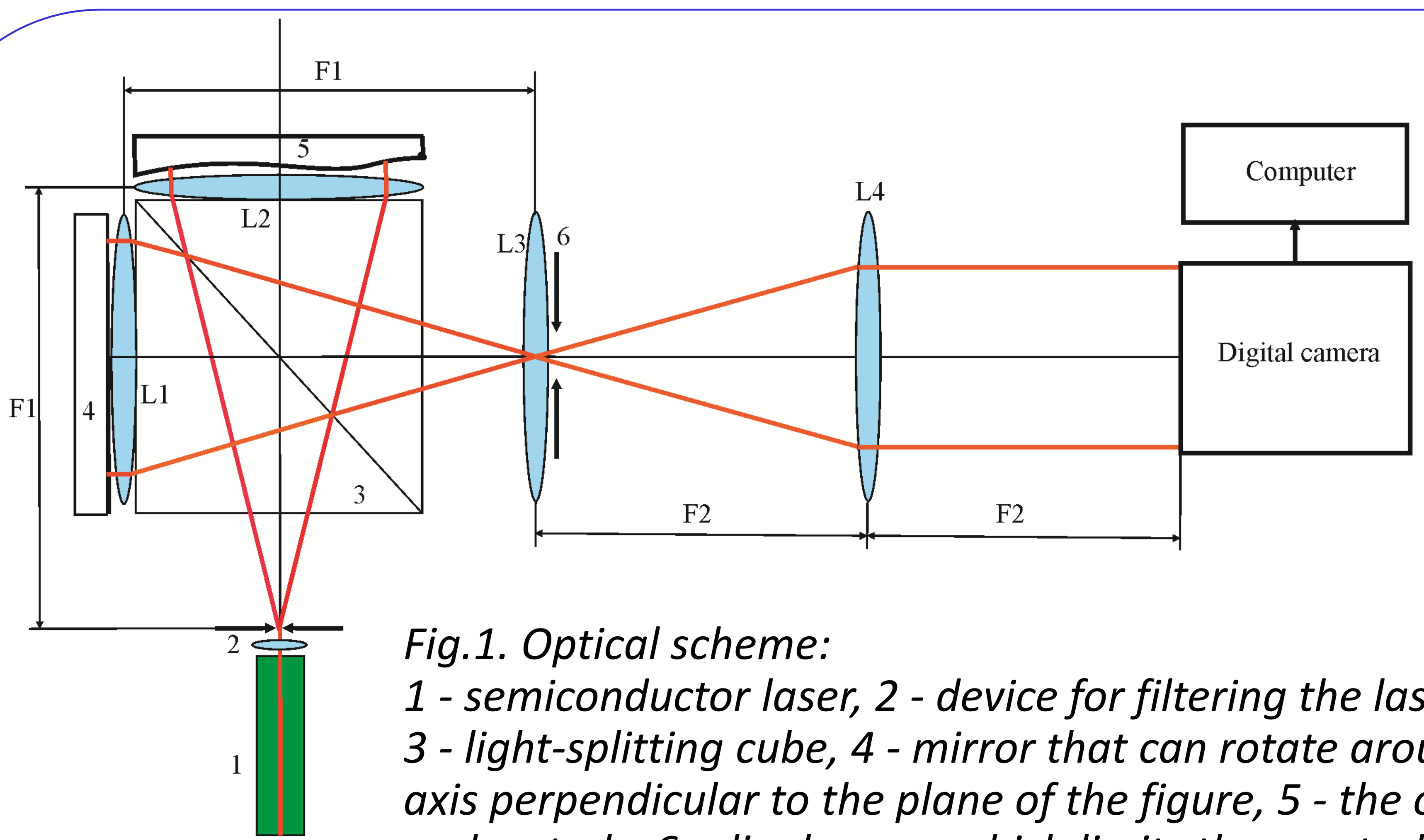


*Fig.1. Optical scheme: 1 - semiconductor laser, 2 - device for filtering the laser beam, 3 - light-splitting cube, 4 - mirror that can rotate around an axis perpendicular to the plane of the figure, 5 - the object under study, 6 - diaphragm, which limits the spectral spatial frequencies of the reflected light from the object, L1, L2, L3 - condenser lenses with the same focal lengths F1, L4 - condenser lens with focal length F2, digital camera and computer*

Software for realization of digital holographic interferometry method has been developed. Experimental tests have shown its effectiveness

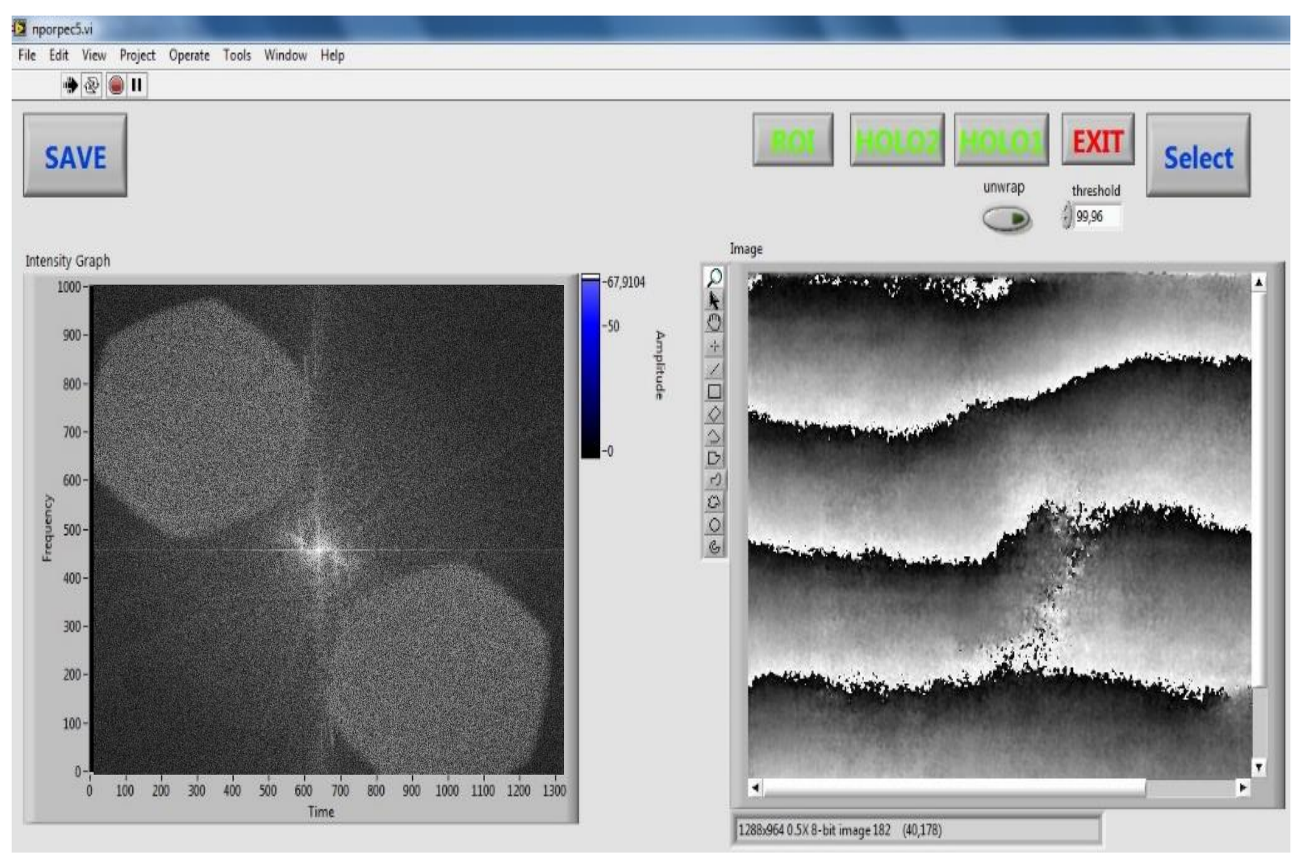


*Fig.2. Working interface for registration and recovery of digital holograms and their filtering*

**Conclusion. The small digital holographic interferometry device makes it possible to quickly obtain high-quality interferograms for the study of small objects. The dimensions of the device allow it to be used for research in unsuitable conditions, easy to transport, etc.**

**Reference:**

1. J.W. Goodman, Introduction to Fourier Optics, McGraw-Hill Book Company, San Francisco, 1967.

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