



COLOR HOLOGRAPHIC INTERFEROMETRY (FROM HOLOGRAPHIC PLATES TO DIGITAL HOLOGRAPHY)

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ABSTRACT: We propose to detail a comparison of optical non invasive techniques using panchromatic holographic plates and digital holography for analyzing unsteady wake flows. Few years ago, ONERA developed optical methods based on real-time three-wavelength holographic interferometry using transmission and reflection holographic plates. These techniques combine the advantages of differential interferometry with those of monochromatic holographic interferometry. We first describe real-time three-color transmission holographic interferometer in which transmission holograms are used. We show that the diffraction efficiency of holograms just reaches ten or twenty percents, that which limits the quality and the contrast of interferences fringes [1].

Then, compact real-time three-color reflection holographic interferometer was developed where reflection panchromatic silver-halide holographic plates are used to simultaneously record three reference holograms. Best results are obtained when the diffraction efficiency of holographic plate reaches 50% for the three used wavelengths. This optical setup was applied to analyze the 2D unsteady wake flow around a circular cylinder at Mach 0.45 (Fig. 1a) [2]. To avoid problems in gelatin shrinkage due to the hologram treatment, ONERA decided to develop digital color holographic interferometry. Here, three interference micro fringes are generated in the observed field (Fig. 1b). A 3CCD sensor records reference (without flow) and measurement (with flow) interferograms and the phase and amplitude maps are computed by direct and inverse 2D Fast Fourier Transforms in delayed time. Results can be directly compared to those obtained in color holographic interferometry using panchromatic plates. An example is given here on the same case in Fig. 1 where color interferences fringes are compared [3].

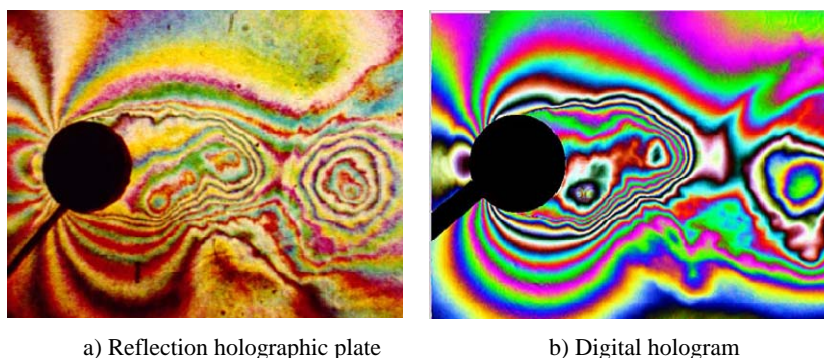


Fig. 1 Comparison of color interference fringes

References

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