FRINGE FORMATION IN DUAL-HOLOGRAM INTERFEROMETRY

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A first order geometrical optics treatment of holograms combined with the generation of interference fringes by two point sources is used to describe reference fringe formation in non-diffuse dual-hologram interferometry.

fringe formation; holographic interferometry; flow visualization

1. INTRODUCTION

Non-diffuse dual-hologram interferometry is one of the more commonly used holographic flow visualization techniques for wind tunnels. The technique was used as early as 1966/1/ with the first major applications of the technique to wind tunnels being made in the early 1970's/2/. With this technique flow and no-flow recordings are made as two separate holograms. Schlieren and shadowgraph are obtained from reconstructions of the flow hologram only, while interferometry is obtained by interfering reconstructions from both holograms. By adjusting the holograms relative to one another in the reconstruction setup various reference (or background) fringe spacings and orientations can be realized, either to emphasize different parts of the flow field or to create more fringe crossings in the region of evaluation.

The adjustments required to produce reference fringes in the dual-hologram interferometer can sometimes appear rather "mysterious" and a mixture of trial-and-error and experience is usually required. The purpose of this paper is to show that a simple first order model is useful as an aid in understanding some of the basic adjustments of the interferometer. First, the generation of fringes by two point sources and the first order imaging properties of planar holograms are reviewed. It is then shown how the first order imaging relationships can be used to describe reference fringe patterns for the typical geometry used in dual-hologram interferometry. Finally it is shown how the first order model can