



Laser-Induced Dynamic Gratings (Springer Series in Optical Sciences) (Volume 50)

Hans Joachim Eichler, Peter Günter, Dieter W. Pohl

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The invention of the laser 25 years ago resulted in powerful light sources which led to the observation of unexpected and striking phenomena. New fields of science such as holography and nonlinear optics developed constituting the basis of this volume. The classical principle of linear superposition of light waves does not hold anymore. Two laser beams crossing in a suitable material may produce a set of new beams with different directions and frequencies. The interaction of light waves can be understood by considering the optical grating structures which develop in the overlap region. The optical properties of matter become spatially modulated in the interference region of two light waves. Permanent holographic gratings have been produced in this way by photographic processes for many years. In contrast, dynamic or transient gratings disappear after the inducing light source, usually a laser, has been switched off. The grating amplitude is controlled by the light intensity. Dynamic gratings have been induced in a large number of solids, liquids, and gases, and are detected by diffraction, 'forced light scattering' of a third probing beam, or by self-diffraction of the light waves inducing the grating. The combined interference and diffraction effect corresponds to four-wave mixing (FWM) in the language of nonlinear optics. The process is called degenerate if the frequencies of the three incident waves and the scattered wave are equal. Degenerate four-wave mixing (DFWM) is a simple method to achieve phase conjugation, i.e. to generate a wave which propagates time reversed with respect to an incident wave.

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