



Waves in Focal Regions: Propagation, Diffraction and Focusing of Light, Sound and Water Waves (Series in Optics and Optoelectronics)

J.J Stannes

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Using numerous mathematical and numerical techniques of diffraction theory, *Waves in Focal Regions: Propagation, Diffraction and Focusing of Light, Sound and Water Waves* provides a full and richly illustrated description of waves in focal regions. Unlike most books, the author treats electromagnetic, acoustic, and water waves in one comprehensive volume.

After an introductory section, the book describes approximate diffraction theories and efficient numerical methods to study the focusing of various kinds of waves. It then covers the physical interpretation of the theories, their accuracy, and the computational savings obtained, emphasizing uniform asymptotic results that remain valid in the vicinity of shadow boundaries and caustics. The next part deals with the focusing of scalar waves, including thorough theoretical analyses and detailed contour maps of diffraction patterns in focal regions for a variety of different system parameters, such as f-number, Fresnel number, aperture shape, amplitude distribution, and wavefront aberration. The author proceeds to explore the diffraction and focusing of electromagnetic waves. First solutions are derived for fields radiated by sources, reflected and refracted at plane interfaces, or diffracted by apertures in plane screens, and then these solutions are applied to study the focusing in homogeneous media and through a plane dielectric interface. In both cases, the author includes many computed results of the electromagnetic field distribution near focus. Presenting both theoretical and experimental results, the following part examines the focusing of sound and water waves by means of zone-plate lenses. The book concludes with a detailed study of the diffraction and focusing of water waves and a comparison of the results of both linear and nonlinear theories with those of experiments.

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