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★**Transionospheric synthetic aperture imaging.**
Applied and Numerical Harmonic Analysis.
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As with all interdisciplinary work, it is a challenge to write a book for applied mathematicians, engineers and physicists with different technical backgrounds and interests, especially on such demanding topics as synthetic aperture imaging and the propagation of radio waves through the ionospheric plasma. The book under review faces this challenge admirably. It is written by distinguished researchers who have made fundamental contributions to the many recent mathematical developments in the analysis of ionospheric distortions of spaceborne SAR images and they have proposed new strategies for their mitigation.

The book is intended for applied mathematicians interested in the area of radar imaging or, more generally, remote sensing, as well as physicists and electrical engineers who develop spaceborne sensors and perform data analysis. The mathematical technicalities are clearly presented within the book, enabling the discussion to be understood by a broad audience. This is a very well written book that is accessible to graduate students in applied mathematics, physics, engineering and related disciplines.

There are nine chapters: 1. Introduction; 2. Conventional SAR Imaging; 3. SAR Imaging Through the Earth's Ionosphere; 4. The Effect of Ionospheric Turbulence; 5. The Effect of Ionospheric Anisotropy; 6. The Start-Stop Approximation; 7. Modeling Radar Targets Beyond the First Born Approximation; 8. Inverse Scattering Off Anisotropic Targets; 9. Discussion and Outstanding Questions. Each chapter gives full details of physical assumptions, numerical approaches and mathematical subtleties.

Chapter 1 contains an introduction to the theory of spaceborne synthetic aperture imaging. It also highlights important topics in the book that are not specific to transionospheric imaging. Chapter 2 describes and presents the mathematical framework of conventional SAR imaging. Chapter 3 summarizes some classical and some more recent aspects of SAR imaging through the Earth's ionosphere. In particular, the distortions of spaceborne SAR images due to deterministic ionospheric effects are described and quantified. Chapter 4 focuses on the effect of ionospheric turbulence. This chapter nicely complements the previous one by now studying the image distortions that are due to the stochasticity of the ionospheric medium. The authors also discuss the effect of ionospheric anisotropy in Chapter 5. This chapter presents an analysis of the effect of the Faraday rotation on transionospheric SAR imaging as well as a method for reducing the corresponding image deterioration. Chapters 6 and 7 describe the start-stop approximation and modeling radar targets beyond the first Born approximation. The key contribution of Chapter 7 is a new model for radar targets for which the standard yet unrealistic assumption of weak scattering is not needed in order to obtain linearity of the inverse problem of reconstructing the reflectivity. The remainder of the book (Chapters 8 and 9) consists of an analysis of scattering off anisotropic targets and a discussion of outstanding problems.

In summary, the monograph is an excellent reference for anyone who is interested in the mathematical theory of transionospheric synthetic aperture imaging. This book is a delightful source of elegant and powerful ideas, packed with mathematical gems and far-reaching applications. It fills a major gap in the literature and will be useful to students and practitioners alike for many years to come. We highly recommend this book. *Alex Mahalov* and *Austin McDaniel*