

Preface

As a combination of polarization and spectral imaging, multi-band polarization imaging has demonstrated a strong potential in a wide variety of civilian and military applications. Conventional imaging devices separately provide spectral information, intensity, and surface characteristics of an object. Multi-band polarization imaging acquires simultaneously the features in reflection, scattering, and transmission, which are beneficial for the detection and identification of an object in challenging environments including concealed, camouflaged, and non-cooperative targets. This book focuses on the discovery and practical applications of multi-band polarization imaging based on the research that the authors have accomplished since 2001. Topics include multi-band polarization remote sensing systems, analysis of multi-band polarization characteristics, effects of camouflage materials on polarization bidirectional reflectance distribution function, and applications of multi-band polarization imaging in target detection.

This book is composed of seven chapters, beginning with an introduction to fundamental theories, state-of-the-art developments, and applications of multi-band polarization imaging. Chapters 2–3 describe electromagnetism, polarization analysis, principles of multi-band polarization detection, and the imaging systems designed by the authors. The methods to reduce polarization measurement errors as well as calibration methods are also described in detail. Chapter 4 contains principles of polarization bidirectional reflectance distribution, the measurement system and the P-BRDF model of coated objects and the background. In Chap. 5, target detection with multi-band polarization imaging is discussed. Various fusion detection methods are compared with theoretical analysis and experimental results. Chapter 6 demonstrates bio-inspired multi-band polarization vision systems and a data restoration technique to expand the field of view. 3D reconstruction and polarization dehazing methods are described in Chap. 7.

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