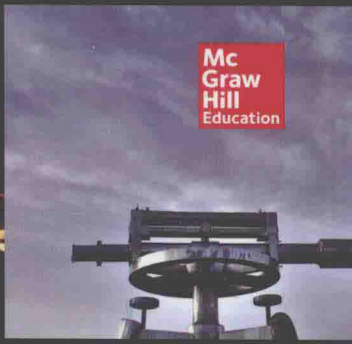
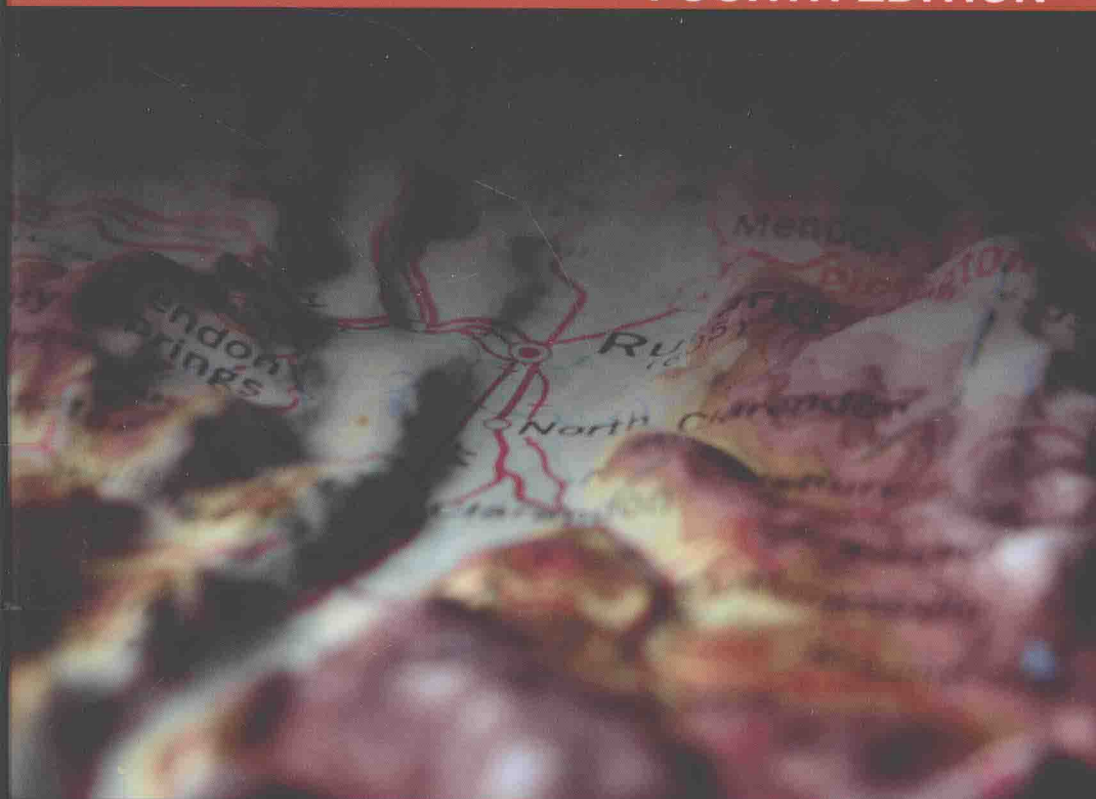


ELEMENTS OF PHOTOGRAMMETRY WITH APPLICATIONS IN GIS

FOURTH EDITION



PAUL R. WOLF BON A. DEWITT BENJAMIN E. WILKINSON

Elements of Photogrammetry with Applications in GIS

Paul R. Wolf, Ph.D.
Bon A. Dewitt, Ph.D.
Benjamin E. Wilkinson, Ph.D.

Fourth Edition

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Preface

In the past decade, technology used in photogrammetry has continued to advance. Much of what was considered emerging technology when the 3rd edition of this book was published is now commonplace in the profession. Although many of the fundamental concepts remain unchanged, the advent of these new tools has required the addition of new principles and practices. In this 4th edition, we have endeavored to update the text and accompanying graphics to address these changes while maintaining the utility and accessibility of previous editions. While many photogrammetric practices have become either automated or extensively aided by computers, it is still important for practitioners to understand the processes carried out in the hardware and software. For example, project data may be captured using a digital camera with integrated GPS and an inertial navigation system (INS), processed in real time, stored immediately in flash memory, and directly integrated into and applied using a geographic information system. However, it is still up to the human developers, operators, and users to ensure that photogrammetric systems and accompanying procedures are functioning efficiently and effectively, and also to ensure that they are taking full advantage of what photogrammetry can provide. This book provides the information needed to understand the background and basic concepts of contemporary photogrammetry, and contains the foundational knowledge required for advanced study and practice in the discipline.

New material includes additional information on digital cameras and other sensors, airborne control and direct georeferencing using GPS/INS, and softcopy stereoplotters. A new chapter devoted to LiDAR has been added which describes the fundamental principles of mapping with airborne laser scanners, and Chapter 20 contains new material on photogrammetric applications in GIS. This new edition contains updated examples of mapping cameras to include state-of-the-art sensors. Many new photos and drawings have been added in order to help portray the material and preserve the hallmark clarity of the previous editions. A four page insert containing color versions of several figures has also been added to more clearly illustrate concepts that are difficult to recognize in gray tone images. New exercises and additional references can be found at the ends of chapters to support the reader's

conceptual understanding and lead them to articles and other resources for further information on specific topics. There are also new examples throughout the book to help facilitate the understanding of key computations and algorithms. In addition to these, there are multiple references to supplementary material which can be found on the book's website, where one can find further examples, problems, and software.

This book can serve as both a practical reference and a textbook that can be used in both beginning and advanced courses on photogrammetry. A perusal of the table of contents shows that the book is comprehensive, covering all of the main topics in the subject. In addition to purely photogrammetric themes, there is background material which includes coverage of mapping coordinate systems, ground control surveying, and digital image processing techniques. Also included are the substantial and revamped appendices that cover the basics of measurements and errors, least-squares adjustment, coordinate transformations, and other topics. The structure of the book is such that topics are ordered sequentially, with subjects introduced and covered in logical order. Thus, the chapters provide a framework for developing a course on the subject. As a reference, this book is suitable for professionals who use photogrammetry in their work including engineers, surveyors, foresters, geologists, and more.

We wish to again acknowledge our sincere appreciation to the many individuals who contributed to the first three editions of this book. And we gratefully acknowledge the people, agencies, and firms who contributed to this fourth edition. In particular, we express our thanks to Tim Wolf (Paul Wolf's son) of the Artisan Group of Companies, USA for providing materials to illustrate use of photogrammetry in GIS, to Gary Florence of Photo Science, Inc. for contributing a 3D, image-draped terrain model used in the cover art for the book, to Gary Johanning of Geodetic Systems, Inc. for providing updated examples and illustrations of close range photogrammetry, to Tom Tibbitts for providing GIS application material, and to Ahmed Mohamed of Geomatics USA, L.L.C. for providing feedback on the GPS and inertial navigation system sections. We also express our appreciation to the instrument manufacturers, government agencies, and private photogrammetric firms who supplied figures and other information for this book.

We also wish to thank our wives, Monica Dewitt and Zhao Han for their support, perseverance, indulgence, and love.

Finally, we wish to express our sincere gratitude, honor, and respect for the lead author of this book, Paul R. Wolf, who passed away in 2002. Although he was not present to participate in the rewrite of this edition, a significant amount of his material still serves as a foundation for the book. He was truly an outstanding mentor and close personal friend, and continues to be greatly missed. We can only hope that we have approached, in some measure, the high standards of excellence that defined Paul Wolf's professional career.

Bon A. Dewitt
Benjamin E. Wilkinson

(*a*)

FIGURE 2-21 (*a*) Normal color image and (*b*) color infrared image. Note that healthy vegetation, which appears green in the normal color image, appears red in the color infrared image. Circled tennis courts are painted green but appear gray in the color infrared image.

(*b*)

FIGURE 2-21 (*Continued*)

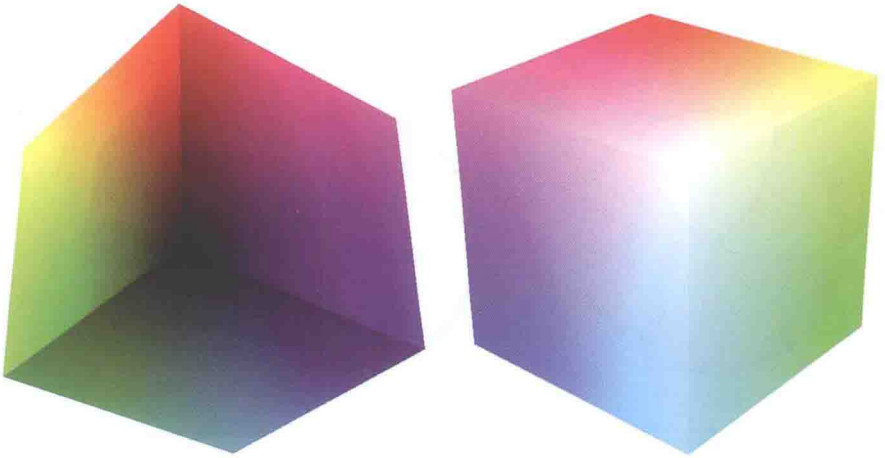

FIGURE 2-27 (*a*) A view of the color cube from behind the origin and (*b*) a view of the color cube from the opposite corner.

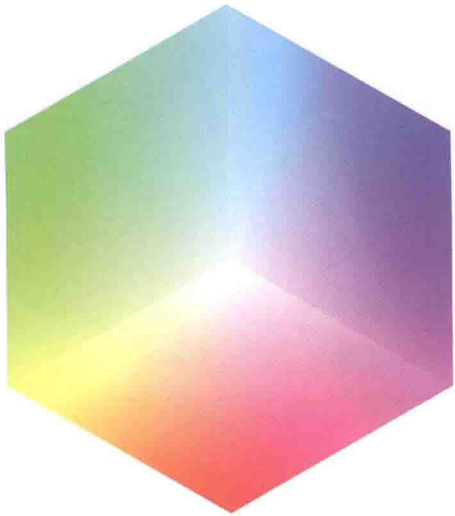

FIGURE 2-30 Representation of hue and saturation corresponding to Fig. 2-29.

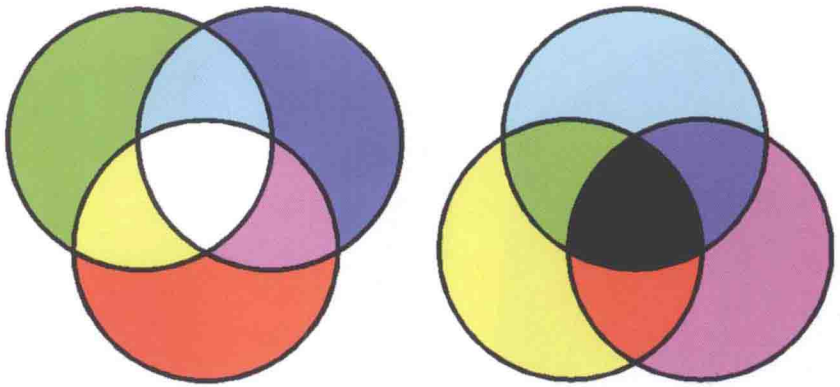

FIGURE 2-31 Illustration of the (*a*) color additive process and (*b*) color subtractive process.

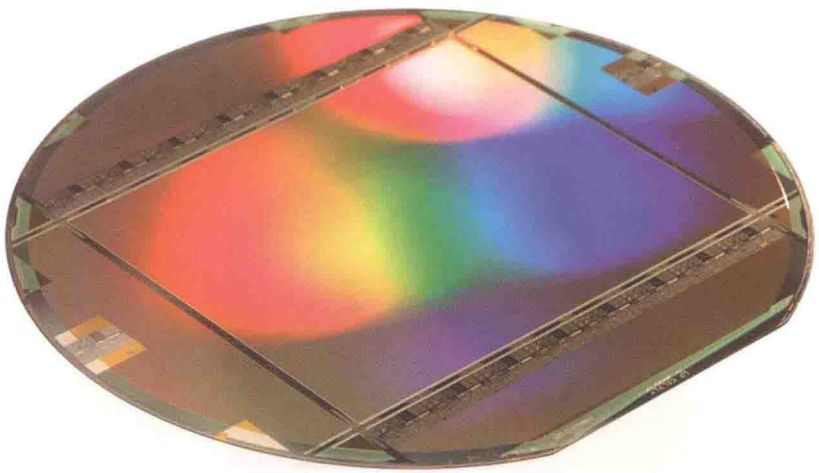

FIGURE 3-9 Solid-state CCD imaging array of 14,600 × 17,200 (250 million) pixels. (*Courtesy Teledyne DALSA.*)

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