



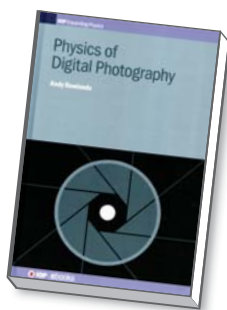
A volume on digital photography enlightens and frustrates

Andy Rowlands, in the preface to his *Physics of Digital Photography*, hopes the book provides “a theoretical overview of the photographic imaging chain” that will be useful “for graduate students and researchers entering imaging science, and for photographers with a graduate level technical background.” I highly recommend this book to its intended audience, with one reservation: It’s difficult to *find* whatever it is you want to read about. Despite bouts of frustration on that score, I must say that as a professional photographer with a doctorate in physics, I often found the book brilliantly enlightening.

As its author promises, *Physics of Digital Photography* leads readers through the imaging chain. Rowlands begins with derivations and explanations of myriad Gaussian-optics formulas and then follows a photographic image from the real world through the entire camera system—switching to wave optics when needed—to a final output image either displayed on a screen or hung on a wall. Along the way he presents technical introductions to the important concepts in the physics of photography, from the obvious topics of focal lengths, f-numbers, and fields of view to the obscure—various transfer- and point-spread functions, multiple sources of noise, aliasing effects that can create false data in an image, and color-rotation matrices.

As a photographer, I enjoyed the tech-

**Physics of
Digital
Photography**
Andy Rowlands
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nical discussions of many familiar concepts, including the limits to the focus-and-recompose technique; sharpness versus resolution; highlight headroom; and especially the relations between voltage gain, noisiness, and dynamic range. Although I was familiar with working color spaces like sRGB, this was my first exposure to reference color spaces like CIE XYZ. However, I admit to skipping the details in the 20 or so pages devoted to matrix conversions of camera-space raw data to output imagery.

The discussion of equivalence in photographic imagery was particularly notable. Equivalence is a critical concept when comparing the image-quality outputs of various cameras and lenses, whether of the same or different sensor formats. Rowlands adroitly walks his audience through how to achieve the required identical perspectives, framing, depth of field, shutter speed, brightness, and display dimensions. Many equipment reviews ignore, to the reader’s

detriment, the information that rigorous equivalence can provide.

In addition to a wealth of information, I wanted *Physics of Digital Photography* to be a good reference resource. It is not, simply because it’s exceedingly difficult to navigate. The table of contents is reasonably detailed but that’s it. Crucially, the book has no index. There is no list of mathematical symbols with the pages of their definitions. The pages don’t even have chapter or subject headers—instead, the title of the book appears at the top of every page. Rowlands does include a dizzying list of the acronyms he uses, but does not provide page numbers to enable readers to find definitions. Those tools, especially a detailed index, are sorely needed to make the book actually useful as a reference work.

Two examples will suffice. The concept of aliasing is mentioned several times in the latter portion of the book. But if you have forgotten or do not know the definition, going back to find its initial mention on page 3–1 and discussion on page 3–47 is nontrivial since aliasing does not appear in the table of contents. Also, I was fascinated by Rowlands’s discussion of metamers and metamer error, concepts previously unfamiliar to me. But when I encountered metamers again days later, I could refresh my memory only after a painstaking, page-by-page search for their introduction.

My final critique involves typographical errors. I spotted a few easy ones: the figure caption on page 1–44 should have “circumference” rather than “radius”; on page 3–5, (x_{op}, x_{op}) should be (x_{op}, y_{op}) ; and on page 5–5, “Figure 1.2” should be “Table 1.2.” My larger concern is that far subtler typos might have crept in that could lead to erroneous readings or interpretations of technical derivations or results. One or two thorough uses of the book in a graduate class should find such errors, if any exist.

Despite the shortcomings, I repeat my strong recommendation of *Physics of Digital Photography* to its intended audience. And I urge the publisher to quickly generate a second edition with an index and more useful appendices. Then Rowlands’s book will be not just an enlightening monograph, but also the valuable reference it deserves to be.

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