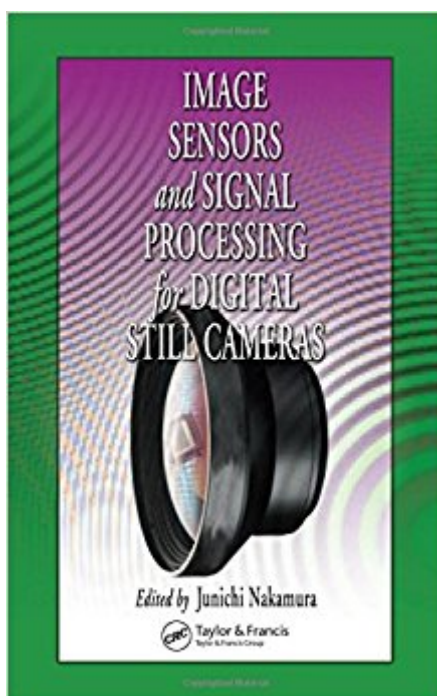


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# Image Sensors And Signal Processing For Digital Still Cameras (Optical Science And Engineering)



## Synopsis

Shrinking pixel sizes along with improvements in image sensors, optics, and electronics have elevated DSCs to levels of performance that match, and have the potential to surpass, that of silver-halide film cameras. *Image Sensors and Signal Processing for Digital Still Cameras* captures the current state of DSC image acquisition and signal processing technology and takes an all-inclusive look at the field, from the history of DSCs to future possibilities. The first chapter outlines the evolution of DSCs, their basic structure, and their major application classes. The next few chapters discuss high-quality optics that meet the requirements of better image sensors, the basic functions and performance parameters of image sensors, and detailed discussions of both CCD and CMOS image sensors. The book then discusses how color theory affects the uses of DSCs, presents basic image processing and camera control algorithms and examples of advanced image processing algorithms, explores the architecture and required performance of signal processing engines, and explains how to evaluate image quality for each component described. The book closes with a look at future technologies and the challenges that must be overcome to realize them. With contributions from many active DSC experts, *Image Sensors and Image Processing for Digital Still Cameras* offers unparalleled real-world coverage and opens wide the door for future innovation.

## Book Information

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## Customer Reviews

This book is on the basic foundations of digital still cameras &#x85; It includes both the theory and the concepts of both the hardware being used and the software that ties everything together &#x85; Dr. Nakamura has gotten a group of people from various companies to write chapters on their own area of expertise. &#x85; [These companies are] a who's who of the digital camera field including: Konica Minolta, Canon, Olympus, Fuji, and various specialized companies&#x85;-Books-On-Line

This is a good reference book for the person working to understand Image Sensors manufactured in silicon technology. It has a good discussion of the manufacturing process. It has excellent references so that the person who wants to further understand the field can dig further. The book is not overly technical. A relatively new person to the field can understand it without being inundated with formulae. It helped me get a clean grasp of the subject in a rather short time. I did need to look up other technical papers to delve into specific areas. This will generally always be the case. The language is well written. A number of contributors have written portions of the book.

This is a good book for history of image sensor. It is not the latest technology using in the industries right now, but it is a well written book for good understanding image sensor.

I have reviewed quite a few books on cameras and image sensors. Being in the business, I have quite a large library of books related to this field. However, Nakamura nailed it all with this book. A very well written - almost in layman's terms - that addresses all the technical components that make up a camera. If you are looking to understand the principles of a digital camera, this book is for you.

This book focuses on image acquisition and signal processing in digital still cameras (DSC's). From the perspective of the flow of image information, a DSC consists of imaging optics, an image sensor, and a signal processing block that receives a signal from the image sensor and generates digital data that is eventually compressed and stored on a memory device in the DSC. Chapters one and two are at a rather high level and introductory. However, in chapter 3 the book gets much more specific. Chapter 3 discusses the functions and performance parameters common to CCD and CMOS image sensors. Chapter 4 describes in detail the CCD image sensors widely used in imaging applications. The chapter ranges from a discussion of basic CCD operating principles to descriptions of CCD image sensors specifically designed for DSC applications. Chapter 5 discusses CMOS image sensor technology. Chapter 6, the final chapter focusing on sensors, describes methods for evaluating image sensor performances relative to DSC requirements. Chapter 7 shifts

gears and begins the discussing of image processing algorithms. The discussion begins with color theory and its application to DSCs. Chapter 8 presents the algorithms utilized by DSC's in both hardware and software. Basic image processing and camera control algorithms are shown along with some image processing examples. Chapter 9 discusses the performance parameters for DSCs and digital video cameras followed by descriptions of the architectures of signal processing engines. Examples of the analog front-end and the digital back-end designs are introduced. Chapter 10 shows how each component previously described affects image quality. The final chapter discusses future DSC image sensors and explores a new paradigm for image sensors. The reader should have an electrical engineering background since there are quite a few circuit diagrams shown involving transistors, and it is hard to follow the discussion if you are not already aware of their theory of operation. It is a very good book for its target audience, but students with pure computer science backgrounds who are coming to this looking for just the mathematics or algorithms of image processing may find themselves lost in the discussions involving pn junctions, which are numerous.

Digital signal processing has been around for a long time. Only since 1995 however has the price/performance ratio of sensors and processors been good enough to allow extremely sophisticated devices using DSP to become consumer items. In 1995 the first really popular digital camera, the Casio QV-10 entered the market and became a great success. Since then, the technology has grown at a phenomenal rate driven by the huge volumes of cameras being sold. This advance shows no sign of slowing down. This book is on the basic foundations of digital still cameras, the image sensor and the techniques used in processing the image coming from the sensor. It includes both the theory and the concepts of both the hardware being used and the software that ties everything together to make a useful system. This field is one that is rapidly changing. As a result Dr. Nakamura has gotten a group of people from various companies to write chapters on their own area of expertise. The companies by whom these contributors are employed is a who's who of the digital camera field including: Konica Minolta, Canon, Olympus, Fuji and various specialized companies that work in this area. Dr. Nakamura is employed by Micron, a major semi-conductor company. This is not a book on how to take pictures, this is a book on what happens underneath when you press the button. It is highly technical, designed for engineers.

Junichi Nakamura did a great job in assembling these chapters by a number of knowledgeable authors on most aspects of state-of-the-art CMOS and CCD imager design. I've only read more

carefully the chapters on optics and CMOS pixel design, but I found them both very well written and inclusive of recent advances and challenges. The book also includes appendices on background material, e.g. photometry. From someone who worked on imagers in Silicon Valley, I highly recommend this book for anyone who wants to see inside contemporary imager design.

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