

Electronics for Radiation Detection

Devices, Circuits, and Systems

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Krzysztof Iniewski

CMOS Emerging Technologies Inc., Vancouver, British Columbia, Canada

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Preface

Human beings historically have had short life spans due to infectious diseases, wars, and natural disasters. Life spans have lengthened considerably in the last century, thanks to improvements in hygiene, medicine, and nutrition. The longer life span, however, has led to a dramatic increase in health care costs and increased efforts to deal with chronic diseases. Further progress in medicine and confinement of exploding health care costs can be expected only with advances in technology, in particular for radiation detectors and front-end electronics.

Among all imaging modalities, those based on ionizing radiation are of primary importance. X-ray-based examinations that include mammography, lung imaging, and computed tomography (CT) scans are used routinely in medical offices worldwide. Single photon emission (SPECT) and positron emission topography (PET) are becoming increasingly popular in nuclear medicine applications in hospitals and large medical practices.

In addition to medical imaging, this book also addresses the applications of radiation detection in other areas, particularly in the rapidly growing field of security applications. Luggage scanning, dirty bomb detection, space missions, nuclear plants, and high energy physics experiments are just a few examples of system applications that utilize x-ray and gamma-ray detection.

Despite different principles of operation among those applications, there are numerous commonalities in the signal processing of signals received by radiation detectors: signal amplification, filtering, multiplexing, and analog-to-digital conversion (ADC). These hardware commonalities among imaging techniques merit the inclusion of all related knowledge and know-how into one publication. After all, equipment for radiation detection that encompasses x-ray, CT, nuclear medicine (SPECT/PET), and security/military uses is a several billion-dollar market that offers tremendous opportunities to integrated circuit (IC) designers.

The book is written by top-notch international experts in industry and academia. The intended audience is practicing engineers with some electronics background. The book might also be used as supplementary material in a graduate course curriculum. I sincerely hope that this book will help improve the understanding of radiation detection electronics and stimulate further interest in the development and use of this equipment to benefit us all.

Krzysztof (Kris) Iniewski
Vancouver, 2009

About the Editor

Dr. Krzysztof (Kris) Iniewski manages R&D at Redlen Technologies, Inc., a start-up company in British Columbia. He is also an executive director of CMOS Emerging Technologies, Inc. (www.cmoset.com). His research interests are in hardware design for biomedical and networking applications. From 2004 to 2006, he was an associate professor at the Electrical Engineering and Computer Engineering Department of the University of Alberta where he conducted research on low power wireless circuits and systems. During his tenure in Edmonton, he put together a book for CRC Press titled *Wireless Technologies: Circuits, Systems and Devices*.

From 1995 to 2003, he held various technical and management positions with PMC-Sierra. During his tenure, he led the development of a number of VLSI chips used in optical networks. Prior to joining PMC-Sierra, from 1990 to 1994, he was an assistant professor at the University of Toronto's Department of Electrical Engineering and Computer Engineering. Dr. Iniewski has published more than 100 research papers in international journals and conferences. He holds 18 international patents granted in the USA, Canada, France, Germany, and Japan. He received his PhD degree in electronics (honors) from the Warsaw University of Technology, Warsaw, Poland in 1988. Together with Carl McCrosky and Dan Minoli, he is an author of *Data Networks—VLSI and Optical Fibre*, Wiley, 2008. He recently edited *Medical Imaging Electronics*, Wiley, 2009, *VLSI Circuits for Bio-medical Applications*, Artech House, 2008, *Circuits at Nanoscale: Communications, Imaging and Sensing*, CRC Press, 2008, and *Next Generation Networks*, Wiley, 2010. Kris can be reached at kris.iniewski@gmail.com.

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