

Foreword

Computed tomography is no longer limited to diagnostic imaging procedures but is nowadays routinely used in interventional radiology. The key requirement of interventional radiologists is a reconstruction time of less than 30 seconds. The usage of hardware accelerators and the development of highly optimized reconstruction algorithms is therefore not an option but mandatory from a practitioner's point of view. Especially the extension of C-arm devices with 3-D imaging capabilities has increased the demands on fast and efficient 3-D reconstruction machines. The assessment of the wide range of modern hardware accelerators for computed tomography is an emerging field. Many research teams work world wide on this problem. The large number of scientific publications on hardware accelerated 3-D reconstruction demonstrates the strong activities in this field. Most of the research is accompanied by industry that has an enormous pressure to get access to low-cost and high performance solutions.

In this book Dr. Holger Scherl considers the field of computed tomography including a review of state-of-the-art reconstruction algorithms and a concise assessment of the most recent hardware architectures. The text introduces the reader to the reconstruction problem in computed tomography and its major scientific challenges that range from computational efficiency to the fulfillment of Tuy's sufficiency condition. The assessed hardware architectures include multi- and many core systems, cell broad-band engine architecture, graphics processing units (GPUs), and field programmable gate arrays. The focus of this book is on the interplay of these recent hardware platforms and modern computed tomography reconstruction algorithms.

Dr. Scherl developed and evaluated a hard- and software framework that is unique and serves as a base for several research projects that deal with hardware accelerated reconstruction. Today the developed system is also used within product implementations in industry, and this particular transfer of the software platform from research to industry is exceptional. The pioneering work is not only appreciated by industry but also by the research community. Holger Scherl's initial publication on the GPU implementation of the reconstruction pipeline using CUDA is referenced more than 50 times.

I consider this book to be unique both in the degree of detail in the experimental evaluation and in the algorithms used for assessment. To my knowledge Holger Scherl is the first researcher considering both modern hardware architectures and most recent computed tomography algorithms.

I am pretty much convinced that the reader of this book will experience many novel aspects of computed tomography algorithms and their implementation on different hardware architectures.

Erlangen, 2011-04-04

Prof. Dr.-Ing. Joachim Hornegger