

Editorial

X-ray Digital Radiography and Computed Tomography

Maria Pia Morigi ^{1,*}  and Fauzia Albertin ²

¹ Department of Physics and Astronomy “Augusto Righi”, University of Bologna, Viale Carlo Berti Pichat 6/2, 40127 Bologna, Italy

² Istituto di Scienze e Tecnologie Chimiche “Giulio Natta” SCITEC-CNR, Via dell’ Elce di Sotto 8, 06123 Perugia, Italy; fauzia.albertin@gmail.com

* Correspondence: mariapia.morigi@unibo.it

In recent years, X-ray imaging has rapidly grown and spread beyond the medical field; today, it plays a key role in diverse research areas. The potential and non-invasiveness of X-ray digital radiography and computed tomography have made X-ray imaging a fundamental tool in different fields, from medical diagnostics to the characterization of materials and industrial components, as well as cultural heritage investigations.

The design and development of new detectors and new X-ray sources, combined with the increased computing power, have made it possible to achieve previously unthinkable results in terms of image quality and spatial resolution, enabling the imaging of even submicron details with lab-based instrumentation.

The aim of this Special Issue, “X-ray Digital Radiography and Computed Tomography”, is to present and highlight novel instrumentation and cutting-edge methods for X-ray imaging, as well as different applications in various fields.

This Special Issue received submissions focused on the most diverse research areas and coming from several different countries—from Europe to the US and Australia. After a rigorous review process, 23 manuscripts were selected—19 research articles and 4 review papers—illustrating the applications of X-ray digital radiography and computed tomography in many sectors, from medical imaging [1–3] to the investigation of cultural heritage objects [4–6], combining X-ray and neutron imaging [7].

Further topics covered in this Special Issue include the use of synchrotron light for phase-contrast and multi-contrast imaging [8–11] and analytical techniques, such as microscopic synchrotron X-ray fluorescence [12]. Several contributions deal with new performing algorithms developed for the suppression of cone-beam artifacts in CT images [13] and signal retrieval from non-sinusoidal intensity modulations in X-ray and neutron interferometry [14], or devoted to innovative techniques, such as multiscale holotomography [15], rotation-free dynamic multi-angle X-ray tomography [16] and high-speed X-ray imaging [17]. The last two research papers describe the implementation principles of a complete CT reconstruction toolchain [18] and the design and realization of a new furnace for in situ wettability experiments at high temperatures under X-ray microtomography [19].

Interestingly, four review papers illustrate the principles and perspective of radiographic imaging with muons [20], an overview of photon-counting spectral imaging detectors [21], a comparison of imaging techniques for biological and biomedical studies [22] and a review of the use of coherent X-rays, from early synchrotron tests to the most recent brain studies [23].

As the Special Issue Editors, we hope that this book will benefit the scientific community and contribute to the spread of knowledge of the numerous and diversified applications of X-ray digital radiography and computed tomography.

We would like to take this opportunity to thank all the authors for their contributions, the reviewers for the efforts to enhance the quality of the manuscripts, and the MDPI editorial team for their assistance in making our editorial tasks easier.



Citation: Morigi, M.P.; Albertin, F.

X-ray Digital Radiography and Computed Tomography. *J. Imaging* **2022**, *8*, 119. <https://doi.org/10.3390/jimaging8050119>

Received: 18 April 2022

Accepted: 19 April 2022

Published: 21 April 2022

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Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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Short Biography of Authors

Maria Pia Morigi completed her Ph.D. degree in physics in 1992 at the University of Bologna, Italy, where she worked first as a graduate technician, then as an assistant professor, and, from 2021, as an associate professor of Applied Physics at the Department of Physics and Astronomy “Augusto Righi”. She is head of the “X-ray imaging Group” of the above department, and her research activity is mainly focused on the development of innovative acquisition systems for X-ray digital radiography and 3D computed tomography, for diagnostic applications and non-destructive testing in the medical, industrial, and cultural heritage fields. Thanks to collaborations with important museums and restoration institutes, her research group has applied its versatile CT systems to the investigation (both on-site and in the lab) of archeological findings and works of art of different sizes and compositions. The group is also part of a strong Italian partnership devoted to cultural heritage investigation and preservation, i.e., INFN-CHNet, a network of the Italian National Institute for Nuclear Physics (INFN). She teaches health physics, physics for cultural heritage, archaeometry, and physical methods of examining cultural property at the University of Bologna. She is the co-author of about 60 papers published in peer-reviewed international journals, 15 book chapters, and more than 100 conference papers or abstracts.

Fauzia Albertin is currently a Fellow at SCITEC (Istituto di Scienze e Tecnologie Chimiche “Giulio Natta”) of the Italian National Research Council (CNR). She obtained her Ph.D. degree in physics at the University of Ferrara, Italy, in 2008, and worked in several research laboratories in Italy (University of Ferrara, University of Bologna, and INFN) and Switzerland (EPFL). Dr. Albertin’s research interests focus on X-ray techniques for cultural heritage investigations and she has participated in several projects, from cutting-edge X-ray imaging techniques for the elemental mapping of painting surfaces to the X-ray tomography of ancient manuscripts. Currently, her research is focused on the development of intersection and data-fusion methodology for the multi-technique and multi-source imaging of works of art.