BOOK REVIEW

Siyong Kim and John Wong: Advanced and Emerging Technologies in Radiation Oncology Physics

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Since 1980s, with the introduction of the application of computers to Radiation Oncology, a ceaseless change in the field has been reported. Increasing computer performance and speed represents more options and feasibilities worldwide and Radiation Oncology is not an exception. The influence of recent changes and developments in other research areas also affected the modern radiotherapy. A book is gathered and edited by two leading radiation oncology physicists, Siyong Kim, from Virginia Commonwealth University and John Wong, from John Hopkins University, whom have an outstanding effort to discuss and to pay considerable attention to the abovementioned changes in radiotherapy. Chapters are also provided by other outstanding experts in their corresponding fields of expertise. The "Advanced and Emerging Technologies in Radiation Oncology Physics" book published in the Medical Physics and Biomedical Engineering series by CRC press is available in both paper and electronic forms.

The book presents most of the recent emerging technologies and the state of the art achievements appeared at radiotherapy field by focusing on major axis categorized as current imaging (Chaps. 1–4), treatment planning and deliveries (Chaps. 5–10), radiation dosimetry and quality assurance issues (Chaps. 11 and 12) and informatics (Chaps. 13 and 14).

In the imaging section, recent developments that can be introduced for radiotherapy aims are described. A comprehensive range of imaging modalities recently developed at the field of Computed Tomography (CT), Magnetic Resonance (MR) based signal processing and imaging, and Positron Emission Tomography (PET) and relevant activities in radiotherapy such as early detection, tumour delineation and biological imaging and modelling are covered in the first section. In the first chapter advances in CT machines such as dual energy CTs and the implication of those in radiotherapy in terms of image quality enhancement and improving dose calculation outcome are extensively discussed. The following section, in contrast, deals with MRI applications in the radiotherapy field. The application of recent parametric images such as perfusion/diffusion weighted images, and 4D MRI can be addressed as a great achievement. Further on, biological imaging as a fundamental structure can be used for radio-biological modelling, biological based treatment planning and tissues response to the radiation. These are discussed in Chap. 3. Consequently, multimodality imaging and relevant issues such as image registration, tissue delineation and relevant challenges are extensively covered in Chap. 4.

The second and third sections of the current book deal with treatment planning and treatment delivery issues. In the second section (Chaps. 5 and 6), recent technical activities focused around computing such as GPU based and cloud-based computing and their profits for radiotherapy are discussed. The essential role of computers for data management, establishing infrastructure and improving the dose calculation algorithms are also taken into account in this section. The third section (Chaps. 7–10) introduces the reader to a range of techniques and devices for more precise delivery within a potentially shorter time. Improvement of current techniques as well as the introducing of novel approaches to monitor intra-fraction targeting, are discussed at the current section. Several significant progresses in recent radiotherapy are reviewed such as tumour targeting, MR guided radiotherapy (MRgRT), heavy charged particle therapy using synchrotrons and Laser-driven ion beams are briefly described.

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In addition, the application of Mcro-beams with high fluence rate as a new approach for radiation delivery is also taken into account. However, due to the lack of appropriate infrastructure and routine applications, the translation of the emerging technologies to the clinic needs to be taken into a serious consideration.

The fourth part of the book introduces a range of subjects to the reader including radiation dosimetry, quality assurance and quality management contents. The dosimetry part of the section (Chap. 11) represents an extensive range of information for new dosimetry systems including liquid filled ionization chambers, solid state, scintillation and luminescence dosimetry, as well as new promising efforts for new dosimeters such as calorimetry, etc. This part opens a great vision towards a new horizon for dosimetric activities based on potentially available dosimeters to acquire the radiation dose in a very short time and very small volumes. Consequently, Chap. 12 deals with radiation delivery safety, and relevant technologies to improve the safety rate at radiotherapy. Discussing about a strong and positive safety culture through a blame-free approach is comprehensively discussed. In order to manage any incidence, different failure mode and effect analysis as a part of quality management tasks as well as incident reporting systems are compared to achieve a safe application of new technologies used in modern radiotherapy.

The last part of the book (Chaps. 13 and 14) concentrates mostly on the role of informatics and data management in radiation oncology. Producing large scale data requires intensive knowledge and background of informatics and big data management, data sharing, data mining for research purposes can consequently lead to outcome prediction and optimized clinical supporting approaches. However, the field has not been entirely addressed as an important area for radiation oncology physicists.

Although the book suffers from inconsistency between sections, it includes most recent state of the art, advanced technologies and relevant approaches developed for Radiation Oncology. In my opinion Chap. 5 could be part of the Computer and Informatics section as a joint chapter to last chapters. The printing version figures are shown in grey scale and this reduces the level of non-written communication. The book possess a great potential to be a reference book for recent developments in radiation therapy field as it provides a great insight and review for most of activities reported worldwide. The book contains lots of novel and key concepts for a bright horizon of advanced radiotherapy. I do believe that editors and authors of the textbook have had a wonderful achievement to provide a comprehensive overview of the current activities in the field.

Apart from very minor issues mentioned, in my opinion, the book can be addressed as part of well-structured emerging books for advanced technology introduced to current radiotherapy. This book is highly recommended to be one of the outstanding reference books for postgraduate students, scientists and researchers in the radiation oncology field who are interested to know about recent efforts.