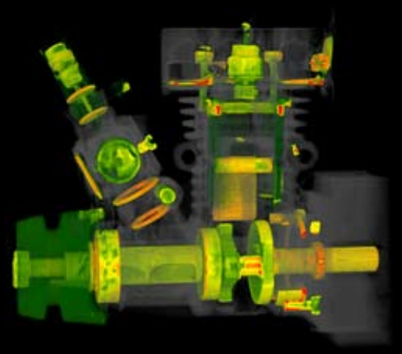
Tomography provides three-dimensional images of heterogeneous materials or engineering components, and offers an unprecedented insight into their internal structure. By using X-rays generated by synchrotrons, neutrons from nuclear reactors, or electrons provided by transmission electron microscopes, hitherto invisible structures can be revealed which are not accessible to conventional tomography based on X-ray tubes.



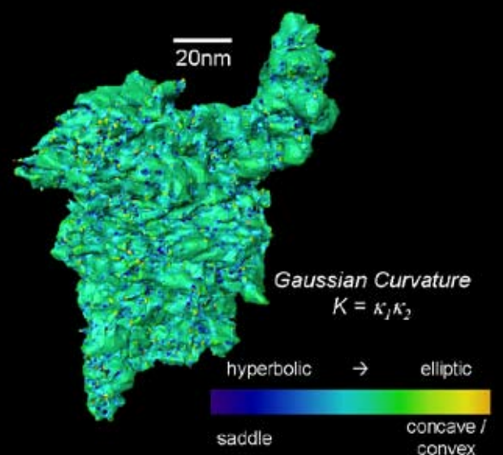
This book is mainly written for applied physicists, materials scientists, and engineers. It provides detailed descriptions of the recent developments in this field, especially the extension of tomography to materials research and engineering. The book is grouped into four parts: a general introduction into the principles of tomography, image analysis and the interactions between radiation and matter, and one part each for synchrotron X-ray tomography, neutron tomography, and electron tomography. Within these parts, individual chapters written by different authors describe important versions of tomography, and also provide examples of applications to demonstrate the capacity of the methods. The accompanying CD-ROM contains some typical data sets and programs to reconstruct, analyse and visualize the three-dimensional data.

Jacket illustrations:

Front: 3D visualization of connected particle clusters in an aluminium foam obtained by synchrotron X-ray tomography. Silicon carbide particles are displayed in colour, the aluminium alloy matrix in grey. Connected particles have the same colour, separated particle clusters appear in different colour codes (see Fig. 5.14, Chapter 5). Reprinted with permission from A. Haibel, A. Rack, J. Banhart, Applied Physics Letters 89, 154102 (2006), Copyright 2006, American Institute of Physics

Reverse, top: Combustion engine of model aircraft (10 cm long) imaged by cold neutron tomography at beam line 'CONRAD' (Position 2) of the Hahn-Meitner-Institute Berlin. Aluminium is shown in grey, highly absorbing components such as seal rings and oil or fuel droplets are given in red-orange. Other metals are displayed in green (brass) or yellow (steel). Courtesy: N. Kardjilov, Hahn-Meitner-Institut Berlin

Reverse, bottom: surface render of a mesoporous silica particle imaged by electron tomography. The surface has been colour-coded according to its Gaussian curvature (product of the two principal curvatures). It highlights the saddle points which turn out to be the preferred sites on which some nano-particles anchor. Courtesy: Paul A. Midgley and Edmund Ward, University of Cambridge



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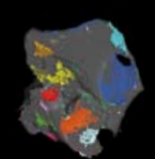
Advanced Tomographic Methods in Materials Research and Engineering



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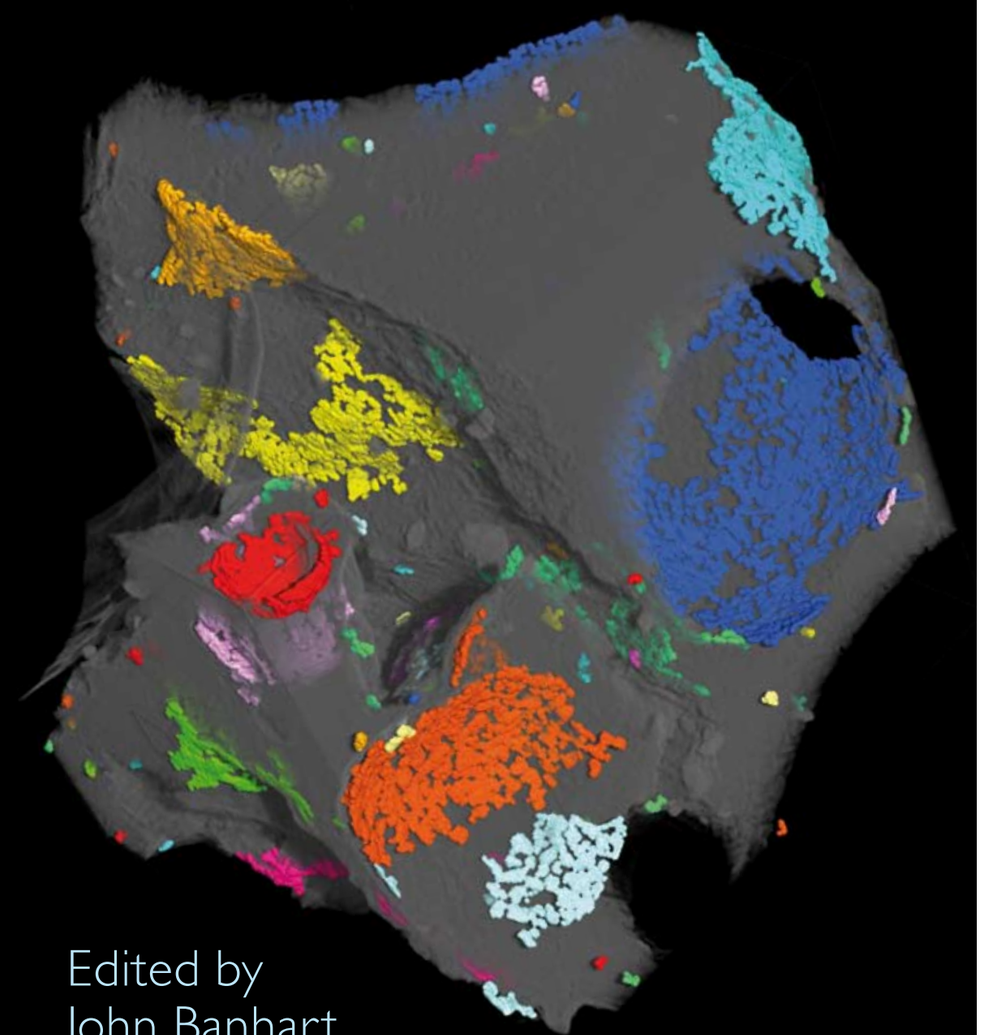

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