Modern image processing techniques are based on multiresolution geometrical methods of image representation. These methods are known to be efficient in sparse approximation of digital images. There is a wide family of functions that are used in such a case. All these methods can be divided into two groups—the adaptive ones, like wedgelets, beamlets, platelets, surflets, or smoothlets, and the nonadaptive ones, like ridgelets, curvelets, contourlets, or shearlets. This book is devoted to the adaptive methods of image approximation, especially to multismoothlets.

Besides multismoothlets, a few new ideas were introduced in this book as well. So far, in the literature the horizon class of images has been considered as the model for sparse approximation. In this book, the class of blurred multihorizon was introduced, which is used in approximation of images with multiedges. Multismoothlets assure the best approximation properties among the state-of-the-art methods for that class of images. Additionally, the semi-anisotropic model of edge (or multiedge) representation was proposed. It was done by introduction of the shift invariant multismoothlet transform. It is based on sliding multismoothlets introduced in this book as well.

The very first definition of this book is a monograph treating about multismoothlets and the related methods. However, the book is presented in an accessible fashion for both mathematicians and computer scientists. It is full of illustrations, pseudocodes, and examples. So, it can be suitable as a textbook or as a professional reference for students, researchers, and engineers. It can be treated as a starting point for those who want to use geometrical multiresolution adaptive methods in image processing, analysis, or compression.

This book consists of two parts. In the first part the theory of multismoothlets is presented. In more details, in Chap. 2 the theory of smoothlets is presented. In Chap. 3 multismoothlets are introduced together with the methods of their visualization. In Chap. 4 the multismoothlet transform and the discussion about its computational complexity are presented. In the second part of this book, the applications of the smoothlet and multismoothlet transforms are presented. In consecutive Chaps. 5–7 the applications to image compression, denoising and edge detection are presented, respectively. The book ends with conclusions and future directions.
This book would not have been written without the support of many people. I would like to thank Prof. Jacek Koronacki for writing the foreword, Prof. Wiesław Kotarski for the help and support, Krzysztof Gdawiec for good proofreading and suggestions, and all my colleagues. I also would like to thank Lynn Brandon from Springer for the endless help in the publishing process and anonymous reviewers for the precious remarks and suggestions, which improved the quality of this book. Finally, I would like to thank my family and all my friends for being with me.

Sosnowiec, May 2013

Agnieszka Lisowska
Geometrical Multiresolution Adaptive Transforms
Theory and Applications
Lisowska, A.
2014, XII, 107 p. 65 illus., 21 illus. in color., Hardcover
ISBN: 978-3-319-05010-2