

Amir Z. Averbuch · Pekka Neittaanmaki · Valery A. Zheludev

## Spline and Spline Wavelet Methods with Applications to Signal and Image Processing

Volume I: Periodic Splines

This volume provides universal methodologies accompanied by Matlab software to manipulate numerous signal and image processing applications. It is done with discrete and polynomial periodic splines. Various contributions of splines to signal and image processing from a unified perspective are presented. This presentation is based on Zak transform and on Spline Harmonic Analysis (SHA) methodology. SHA combines approximation capabilities of splines with the computational efficiency of the Fast Fourier transform. SHA reduces the design of different spline types such as splines, spline wavelets (SW), wavelet frames (SWF) and wavelet packets (SWP) and their manipulations by simple operations. Digital filters, produced by wavelets design process, give birth to subdivision schemes. Subdivision schemes enable to perform fast explicit computation of splines' values at dyadic and triadic rational points. This is used for signals and images upsampling. In addition to the design of a diverse library of splines, SW, SWP and SWF, this book describes their applications to practical problems. The applications include upsampling, image denoising, recovery from blurred images, hydro-acoustic target detection, to name a few. The SWF are utilized for image restoration that were degraded by noise, blurring and loss of significant number of pixels. The book is accompanied by a Matlab based software that demonstrates and implements all the presented algorithms. The book combines extensive theoretical exposure with detailed description of algorithms, applications and software.

The Matlab software can be downloaded from <http://www.extras.springer.com>

Electrical Engineering



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