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Development and Application of Image Analysis Techniques for Identification and Classification of Microscopic Particles

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TO MY WIFE

for her help, cooperation, patience and encouragement

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TABLE OF CONTENTS

PREFACE	v
PART 1: IMAGE PROCESSING TECHNIQUES	1.1
1.1. Basics of image formation	1.2
1.1.1. Image formation in SEM	1.3
1.1.2. Image formation in TEM.....	1.5
1.2. Image processing software	1.7
1.2.1. KS400	1.7
1.2.2. Image processing/analysis software developed.....	1.8
1.2.3. Image processing with MathCAD and MatLab	1.11
1.3. Image storage and manipulation	1.13
1.3.1. Windows bitmap file format	1.13
1.3.2. Sun raster file format	1.16
1.4. Image enhancement	1.23
1.4.1. Gray level histogram modifications.....	1.23
1.4.2. Smoothing of noisy images	1.25
1.4.3. Sharpening	1.28
1.5. Image segmentation	1.29
1.5.1. Global thresholding using a correlation criterion	1.29
1.5.2. Local binarization using discrete convolution	1.33
1.5.3. Segmentation based on watershed transform	1.39
1.6. Processing of binary images	1.40
1.6.1. Image enhancement.....	1.40
Binary morphology	1.41
Shrink and swell filters.....	1.43
1.6.2. Contour following techniques	1.44
'Turtle' procedure	1.45
Crack following	1.45
Border following.....	1.48
1.6.3. Perimeter estimation by different yardsticks	1.49
1.6.4. Contour filling and object labeling.....	1.50
1.6.5. Watershed segmentation of touching objects.....	1.53
References	1.55
PART 2: SHAPE ANALYSIS	2.1

2.1. Functional approach	2.2
2.1.1. Contour functions	2.2
Cross-section functions for symmetric figures	2.2
Radius-vector functions	2.4
Support functions	2.6
Width function	2.8
Contour parametric and contour complex functions	2.9
Tangent-angle function	2.11
The intrinsic equation of the contour	2.13
Concluding remarks on contour functions	2.14
2.1.2. Application of contour functions to shape analysis	2.14
Invariant contour function parameters	2.15
Line moments and invariants	2.16
Approximation of contour functions by other simple functions	2.19
Fourier analysis of contour functions	2.21
Some other possible series expansions of contour functions	2.26
Multiscale shape analysis using continuous wavelet transform	2.28
Shape curvature scale space representation	2.30
2.2. Set theory approach	2.32
2.2.1. Simple geometrical shape parameters	2.32
2.2.2. Fractals in shape analysis	2.37
Definition of fractal dimension	2.37
References	2.40
PART 3: APPLICATIONS	3.1
3.1. Classification of individual fly ash and soil dust aerosol particles	3.2
3.1.1. Introduction	3.2
3.1.2. Types of shapes of aerosol particles	3.3
3.1.3. Fractal description of particle shapes: a brief overview	3.4
3.1.4. Experimental	3.6
3.1.5. Results and discussion	3.7
3.1.6. Conclusions	3.10
3.2. Differentiation between individual algae cells and their agglomerates	3.11
3.2.1. Introduction	3.11
3.2.2. Complex Fourier shape description	3.12
3.2.3. Classification algorithms	3.13
3.2.4. Experimental	3.14
3.2.5. Results and discussion	3.15
3.2.6. Conclusions	3.16

3.3. Classification of tabular grain silver halide microcrystals according to their shape	3.17
3.3.1. Introduction	3.17
3.3.2. Shape representation of the microcrystals	3.18
3.3.3. Reconstruction of the shape of overlapping microcrystals	3.21
Extraction of hexagonal and truncated triangular microcrystals	3.22
Extraction of triangular microcrystals.....	3.26
3.3.4. Classification of microcrystals via their shape descriptors	3.27
Nearest neighbor classification algorithms	3.28
Labeled samples and prototypes.....	3.29
3.3.5. Experimental	3.30
3.3.6. Results and discussion	3.31
3.3.7. Conclusions	3.34
3.4. On fractal dimension calculation	3.35
3.4.1. 'Hand and dividers' method: theory	3.35
3.4.2. 'Hand and dividers' method: practice	3.36
3.4.3. Problems associated with the 'hand and dividers' method	3.37
3.4.4. Analysis of the Richardson plot	3.49
3.5. Study of quasi-fractal many-particle systems and percolation networks	3.58
3.5.1. Introduction	3.58
3.5.2. Experimental	3.59
Samples and sample preparation and image acquisition	3.59
Image processing and analysis	3.59
3.5.3. Results and discussions	3.60
Ag colloids.....	3.60
Ag filament networks	3.63
3.5.4. Conclusions	3.65
References	3.66
SUMMARY	S.1
SAMENVATTING	S.3
APPENDIX	A.1
A.1. Publications in refereed scientific journals and conference proceedings	A.1
A.2. Conference contributions	A.2
A.3. Research reports	A.3

PREFACE

Besides classical spectroscopic methods, imaging methods are more and more used in analytical chemistry. Computer-based image analysis systems have become increasingly widespread over the past decades. Computers are used not only to collect information and represent it in a form of a digital image but also to improve the visual appearance of images, to prepare images for measurement of the features and to perform the measurements.

The present work discusses a number of problems where imaging methods can be applied. Different aspects of development and application of image processing and analysis techniques used to characterize and classify microscopic objects according to their shape are described. The text of the thesis is organized in three parts:

Part 1 gives an overview of image formation processes and basic image processing topics. Part of the work was devoted to writing software to perform common image processing functions and implement new techniques. Description of the software can be found here.

Part 2 is a systematic review of different mathematical aspects of shape analysis.

Part 3 consists of examples of different applications of image analysis to solve real problems.

All software, collected images, materials which were used to write articles during the study, and the thesis itself are available on CD-ROM included in this thesis.