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3D Image-based Analysis of Paper Fiber Structures in Paper Products.

ABSTRACT - Masterthesis

Paper is a very versatile material that is used in many different areas, be it as a newspaper, packaging material or as a hygiene article. The manufacturing process of paper has evolved over the centuries. Starting with manual production by the Chinese in the second century to production with advanced large-scale machines today. The worldwide production of paper and paperboard exceeds 300 million tons per year. Although the principal idea of the manufacturing process has remained the same for the past 500 years, the step towards automation has increased exponentially over the recent years.

A discrete three-dimensional (3D) image is numerically an array of values assigned to a 3D grid. With the help of high-resolution 3D images of materials that are recorded by imaging methods such as computer tomography, it is possible to analyze the internal structure of materials by making use of various image processing methods. Due to the varying tasks in the specific areas, many different processes, for example filtration, segmentation, labeling of individual objects or other morphological operations have been developed and established.

The main aim of this Thesis is to develop a suitable algorithm, to analyze and characterize the properties of paper fiber networks based on 3D binary and grayscale images. Depending on their field of application paper products require specific properties, for instance, strength, smoothness, or opacity. These macroscopic properties of paper are mostly determined by the micro structural fiber network. Studying this interaction between microstructure and macroscopic properties of paper may ultimately result in quality improvements for specific paper applications.