

Abstract

In the Paper and Paperboard industries the surface topography is the essence of the production and constant efforts are being made to improve it. Accurate measurements of the surface topography are equally important in order to monitor and maintain the surface quality to be as smooth as is possible throughout the production. Generally, the topography is considered as being the most decisive paper property which has an effect on both the printability and gloss, and also influences the perceived surface quality. Presently the surface is being measured in a laboratory by methods which are mainly based on air leak, stylus and optical techniques. The laboratory measurements have a number of limitations and the most critical is that only a few samples are measured which cannot accurately represent the topography of the entire tambour. Furthermore, the majority of the lab equipment measures the surface roughness in a single variable of average roughness R_a or R_q and this has proved to be inadequate for characterizing the surface quality comprehensively.

The online topography measurement of a paper web moving at high velocities is an important and challenging research area. The online setup can be arranged either in the Cross Direction (CD) or the Machine Direction (MD) on a paper web. In order to discover the topography differences between the CD and MD, a case study was performed in the laboratory for samples of newspaper, light weight coated papers (LWC), coated paperboards and uncoated paperboards. The study reveals that the measurements in the CD yield higher topography details for shorter wavelength roughness.

The online surface measurement is presented by using a recently developed prototype, the Online Topography device (OnTop), which was designed on a line of light triangulation technique and scans the paper along the CD. It gives topographical information while the paper is being processed which can be of assistance in making the surface smooth and the process efficient. For accuracy and validity, the measurements from the OnTop were compared with the available offline industrial devices and a linear regression match between the offline and online measurements was found in range 82% to 96%. The online topography characterization was successfully achieved for various grades of paper and paperboards, including the samples from the same family of material and quality grades, such as the edge and the middle position coated paperboard reels, with an average roughness R_q and in a wide wavelength spectrum from 0.1 to 10mm. The thesis also explains the necessity for and the essence of online topography in the paper industries and describes the design techniques employed in order to develop the prototype.

The online experimental results, by using OnTop, prove that the exploitation of a simple laser triangulation technique can be a valuable application especially in the paper and paperboard industries and has potential in relation to the other industrial applications.