

Process modeling for more efficient pulp and paper manufacturing

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Daniel Ekbåge. Credit: Karlstad University

Integrated paperboard manufacturing consists of a number of unit processes that continuously generate large amounts of process data. Manufacturing is energy-intensive and variations must be taken into

account to achieve the optimal production process. A new thesis at Karlstad University shows how different mathematical models can be applied to the processes in aspects of improved product quality and reduced energy use.

"I have studied the conditions that exist for statistical and mechanistic models for predicting [pulp](#) and paperboard properties and for increased energy efficiency," says Daniel Ekbåge, who successfully defended his [doctoral thesis](#) on process modelling in pulp and paper manufacturing.

The production process of pulp and paper is configured by several unit processes that create a network of flows consisting of [wood chips](#), chemical pulp, mechanical pulp, paperboard and other important components. Both process and quality measurements are used to monitor and control the processes, which are continuously collected in the process data system. The process data contain valuable information about underlying patterns and variability, and with the use of statistical and multivariate analysis, you can gain insights into how reduced variations and prediction of important properties can be achieved.

Process modelling of product quality and energy

A large part of the study is about the mechanical pulp process where wood chips are mixed with chemicals before being processed with mechanical loads under elevated temperature in the refiner. Some of the challenges in this process are the consumption of electricity and that the process data are measured often, while the properties of the pulp are measured less often, which is unfavourable in terms of optimisation. To study the conditions for a dynamic model and multiple regression models, these have been applied to data from the process and the pulp to investigate predictions of the pulp dewaterability and strength. The doctoral thesis consists of several sub-studies that include energy recovery in the evaporation process, modelling of the strength properties

of the paperboard and mapping of the property development in the material during a grade change.

"Process and quality data at the mill is a valuable asset that can also consist of complex correlations. It has been interesting to study how modern calculation techniques can provide support for improved production and my study also emphasises the importance of the combination of knowledge about both the process and different modelling methods when evaluating the applicability of a [model](#) in the production process," says Daniel Ekbåge.

More information: Process modelling in pulp and paper manufacture: Application studies with aspects of energy efficiency and product quality. [www.diva-portal.org/smash/get/ ... 27921/FULLTEXT02.pdf](http://www.diva-portal.org/smash/get/.../27921/FULLTEXT02.pdf)

Provided by Karlstad University

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