VIPP VALUES CREATED IN
FIBRE-BASED PROCESSES
AND PRODUCTS

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VIPP GRADUATE SCHOOL ABOUT TO REACH FINISHING LINE

VIPP Graduate School, which started in 2011, will reach the finishing line at the end of 2020. The occasion is celebrated with an event in connection with Papermakers Light on 12 November.

“During this year, we will work hard to complete all projects and create conditions that will enable all our doctoral students to graduate”, says Magnus Lestelius, professor of chemical engineering and new programme director of VIPP Graduate School. “We are going to make use of our experiences from the graduate school as we plan for the future and continued collaborations with the business sector. We hope that the event will be a memorable occasion, as well as the start of something new.”

Grand finale 12 November
VIPP Graduate School’s grand finale will take place 12 November in connection with Paper Province Papermakers Light, gathering representatives of the regional forest industry, this time online, with inspiring speakers and networking with people from the industry.

Collaboration for strong research and professional development
VIPP stands for value creation in fibre-based processes and products, and is a unique initiative in the Swedish educational landscape with the aim of strengthening the university’s research environments and promoting professional development in the business sector.

The graduate school is a collaboration between chemical engineering, chemistry, environmental and energy systems studies, physics, machine and materials engineering, and the Service and Research Centre (CTF) at Karlstad University and a number of companies mainly in the forest industry in Sweden and Finland. The graduate school has three main areas on which it resides:
Manufacturing and material-oriented research (paper & mass)
Research on energy and environmental aspects (energy and environment)
Research on value creation processes and service perspectives (services)

The project has been funded by the participating companies, the Knowledge Foundation and Karlstad University with a total of SEK 85 million. During the project period 2011-2020, 18 externally employed doctoral students have conducted their doctoral studies within the graduate school.

PROCESS MODELLING FOR MORE EFFICIENT PULP AND PAPER MANUFACTURING

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.

Research collaboration
The study was conducted within VIPP, the graduate school for value creation in fibre-based processes and products at Karlstad University, and was funded by Stora Enso, the Knowledge Foundation and Karlstad University.

REPORTS:

- Process modelling in pulp and paper manufacture: Application studies with aspects of energy efficiency and product quality, Daniel Ekbåge, 2020, Stora Enso Group R&D
- Open Service Innovation in Industrial Networks, Per Myhrén, 2019 Paper Province
- Where did the ink go? -The effect of liquid absorption on ink distribution in flexography, Sofia Thorman, 2018 RISE
- The Impact of Dissolved Matter on Fiberline Processes, Caroline Wilke 2018, BTG
- Trough air drying, Thermographic studies of drying rates, drying non-uniformity and infrared assisted drying, Aron Tysén 2018, RISE
- Effects of plasticizing and crosslinking on coatings based on blends of starch-PVOH and starch-lignin, Asif Javed 2018, BillerudKorsnäs
- Process modelling based on data from an evaporation and a CTMP process: Analysis of energy efficiency and process variability, Daniel Ekbåge 2018, Stora Enso
- Apply heat pump systems in commercial household products to reduce environmental impact: How to halve the electricity consumption for a household dishwasher, Peder Bengtsson, Asko
- Structure-Performance Relations of Oxygen Barriers for Food Packaging, Åsa Nyflött, Stora Enso
- The initial phase of sodium sulfite pulping of softwood - A comparison of different pulping options, Raghu Deshpande, MoRe Research
- Added value from biomass by broader utilization of fuels and CHP plants, Christer Gustavsson, Pöyry
- Through air drying. The influence of formation and pulp type on non-uniform drying and air flow., Aron Tysén, Innventia AB
- Increasing the value of household appliances by adding a heat pump system. Peder Bengtsson, Asko Appliances AB
- Structural Studies and Modelling of Oxygen Transport in Barrier Materials for Food Packaging. Åsa Nyflött, Stora Enso
- Absorption Non-uniformity Characterisation and its Impact on Flexographic inc Distribution of Coated Packaging Boards, Sofia Thorman, Innventia
- Fenton Pre-treatment of a Birch Kraft Pulp for MFC preparation, Pia Hellström, Akzo Nobel Pulp and Performance Chemical
- The initial phase of the sodium bisulfite pulping of softwood dissolving pulp, Raghu Deshpande, Domsjö/MoRe Research AB
- Effects of plasticizing and crosslinking on the mechanical and barrier properties of coatings based on blends of starch and poly(vinyl alcohol), Asif Javed, Billerudkorsnäs AB
- Added value from biomass by broader utilization of fuels and chip plants, Christer Gustavsson, Pöyry
- The initial phase of sodium sulfite pulping of softwood - a comparison of different pulpin options, Raghu Deshpande, MoRe Research

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