PAPER TECHNOLOGY INTERNATIONAL

THE JOURNAL OF THE BIOFOREST PRODUCTS SECTOR

PITA PAPER*matters!* 2018 Conference & Exhibition at Lancaster University

Consortium Project:
"Simulation aided Control of Drying Process"
Peter Fisera (ProcSim)

Peter Fisera

Procsim

Peter worked for SAPPI and Andritz worldwide in pulp cooking, washing and drying processes for more than 25 years. Heaving enough experience I started own company Procsim = Process Simulations 8 years ago (see www.procsim.eu). In this time I cooperated with Voith, Mondi, TU Graz, AutomationX and other organisations on digitisation of technological Processes. I believe that the simulation is the most effective way to discover potentials for improvements.

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PITA's PAPER matters! 2018

"Paper's coming home!"

Mathematical Modelling – Can you really save Energy in the Dryer Section using a Slide Rule?

Consortium Project:

"Simulation aided Control of Drying Process"

80% of heat energy in a paper Mills is used by paper drying!

Enough to search for improvements!

The trials made by UK universities Manchester and Cambridge as well as Perceptive Engineering Ltd (2011) show realistic potential of reducing the energy used in papermaking **by at least 20%** (presented at TAPPI PaperCon USA 2011)

Similar potential has been confirmed by previous IEEA funded study (conducted in 2010).

Also the trials made by AutomatioX and CF Procsim and published in "Paper Technology" show high potential for energy reduction in paper making (also presented at TAPPI PaperCon USA 2014).

10 % of heat energy reduction, what does it means?

A paper mill with annual production of 200.000 tons will save around 40.000 tons LP steam. This represents approximately 25 GWh/y, which corresponds to the **heating for 2000 standard family houses.**

This decreases operational costs by at least £ 1million

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Evidence to date shows there are a good prospects of reducing the energy in:

- Press section 5-6% => £k 500
- Heat recovery system 4-5% => £k 400
- Drying section 3-4% => £k 300

Based on annual production 200.000 tons

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How could the energy be reduced ?

Key information from process!

- The mills are equipped with 3 steam flow meters, if at all
- No online information about dryness after press section
- Not enough information about air in PM hood

Flexible, fast and precise control software!

- control reactions inflexible and unwieldy.

Continuous observing of equipment efficiencies!

- No information about equipment efficiencies at all

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Conclusion of research work done at Perceptive Engineering Ltd and Universities of Manchester and Cambridge

Conclusion

- A significant reduction in the energy consumed in paper making is possible using Advanced Process Control (APC). Methodology:
  - Model the machine as a multivariable process
  - Use this model to design a multivariable model predictive controller
  - Run the controller with powerful real-time optimisation functionality
- Evidence to date shows there are good prospects of reducing the energy used in paper making by at least 20%:
  - 10% reduction from better control of wet end stability
  - Up to another 10% reduction by better control of sheet drainage
  - There are prospective further benefits, not yet quantified, arising from:
    - Better control of the dryer, using all available dryer variables
    - Optimisation and better regulation of the dryer hood

TAPPI PaperCon 2011

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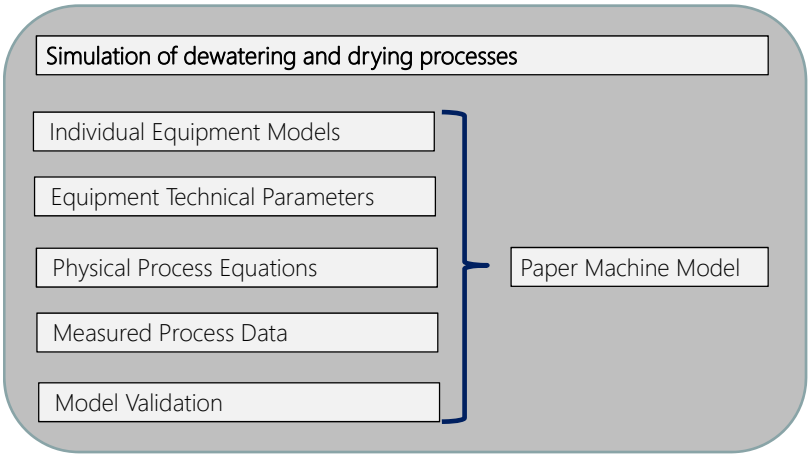
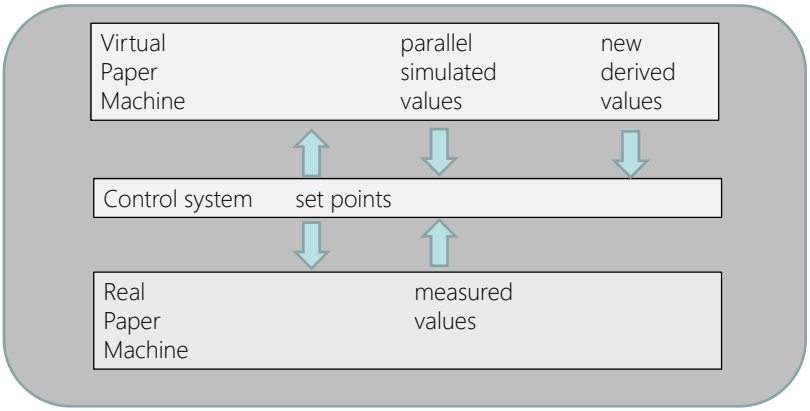
First methodology point:

Model the machine as a multivariable process!



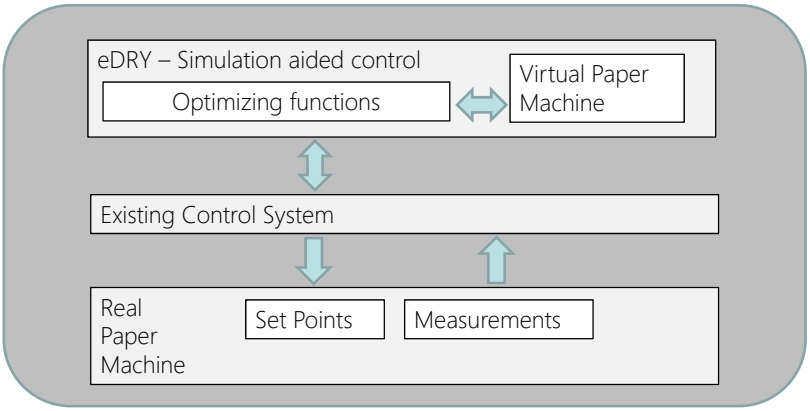
Innovative control technology is based on two nearly identical processes (real and virtual) running in parallel. This technology enables to derive so far not available and difficult-to-measure new process values



Second methodology point:

Use this model to design a multivariable model predictive controller!

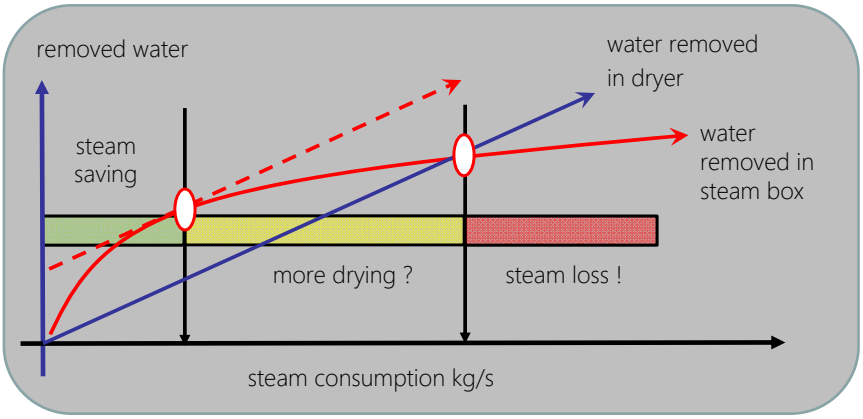
The control technology is based on new software architecture



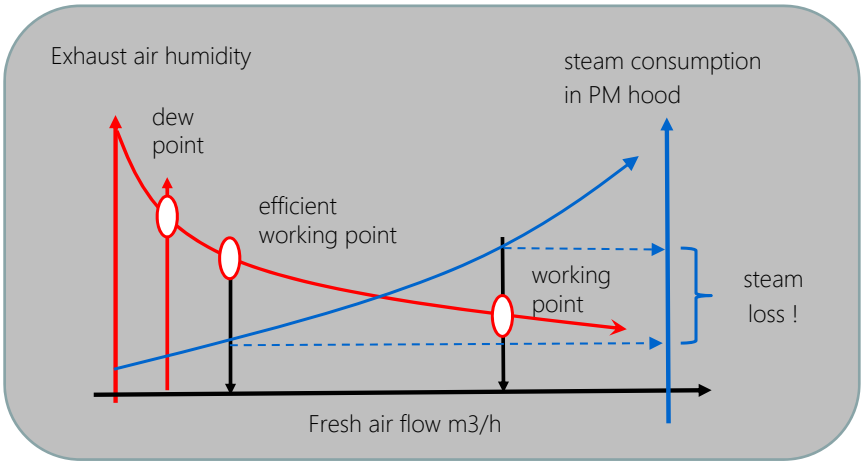
Third methodology point:

Run the controller with powerful real-time optimization functionality!

Efficiency of press section as a function of web dryness after press.



Efficiency of heat recovery as a function of dew point in the PM hood.



Real-time Optimization Functions for Press Section

New functions:

- Online monitoring of the efficiency of press section
- Online monitoring of the web dryness after press section
- Control of the steam box efficiency
- Optimized control of the felt cleaning functions

Potential for energy reduction 5-6%

Real-time Optimization Functions for Drying Section

Optimized functions:

- Fast control of the steam pressure for all steam cylinder groups
- Fast start-up after break
- Fast grade change
- Precision control of the paper final dryness

New functions:

- Monitoring of the cylinder shell temperature
- Optimized control of the first and last cylinder shell temperature

Potential for energy reduction 3-4%

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Real-time Optimization Functions for Heat Recovery

Optimized functions:

- Great dependent control of the exhaust air moisture
- Great dependent heating of the fresh air

New functions:

- Monitoring of the heat exchanger efficiency

Potential for energy reduction 4-5%

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Energy reduction can only be fully successful, if all processes are solved as a one unit online – Multivariable process simulation

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Technology pre-screening by Carbon Trust

"You are welcome to tell potential partners that your technology solution has been "pre-screened" by the IEEA team, and that we believe that it is likely to be eligible for the IEEA and suitable for a full application, with good support from an industrial partner."

IEEA team 24.05.2018

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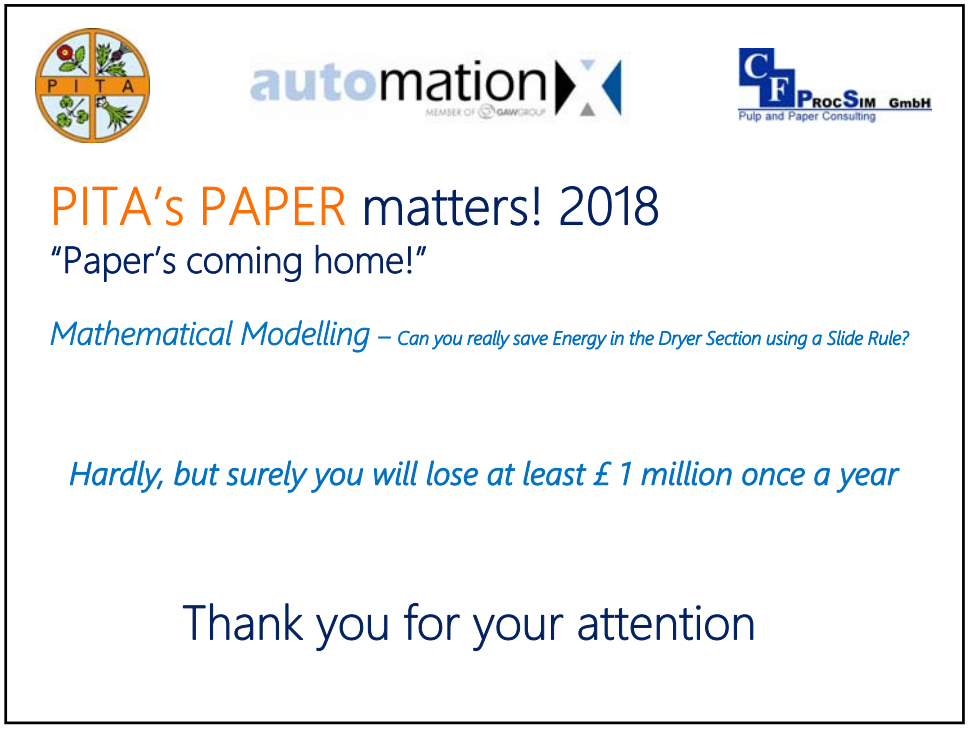
PITA
automationX
MEMBER OF GAW GROUP
CF ProcSim GmbH
Pulp and Paper Consulting
PITA's PAPER matters! 2018
"Paper's coming home!"
Mathematical Modelling – Can you really save Energy in the Dryer Section using a Slide Rule?
Hardly, but surely you will lose at least £ 1 million once a year
Thank you for your attention