

ahead

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MAGAZINE FOR INDUSTRIAL AUTOMATION

INSIDE:

Process and plant optimization

How to collect and use data to improve
your production while lowering costs

ANDRITZ

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FORESEE DIGITALLY WITH METRIS

The ANDRITZ umbrella brand for digital solutions



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A SELF-DRIVING MILL?

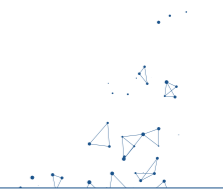
How Metris OPP helps making the Celulose mill more autonomous



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IDEAS

Expanding horizons



Moving AHEAD in industrial automation

The ANDRITZ GROUP has an excellent reputation around the world for its comprehensive portfolio of products and services in key industries such as pulp and paper, power, hydro, metals, and separation processes. For decades, we have been integrating electrification and automation systems into virtually all our deliveries. These activities are

taking on a much more critical and prominent role as industries quickly shift to digitally driven production to improve efficiencies and reduce costs.

Our automation experts have worked closely with our business areas and product specialists for many years – to fully understand customer requirements, process

requirements, and the nuances of the production machinery and arrive at customer-centered solutions. Reliable ANDRITZ Automation solutions are characterized by sustainable process optimization of the plants to make them even more efficient and profitable.

This close working relationship serving key industries gives ANDRITZ Automation broad expertise and a comprehensive portfolio of AEI (automation, electrification, and instrumentation) solutions as well as drive systems. Globally, we have more than 2,000 engineers at 110 locations who are designing, building, configuring, and commissioning tailor-made and vendor-independent AEI solutions.

We are very excited to present this first issue of *AHEAD Magazine for industrial automation*. In addition to explaining our automation portfolio in more detail and highlighting key projects, we hope that it will inspire you in your quest to optimize your plant – and let you know that you have a competent automation partner available to support you.

Let's enjoy the journey together – AHEAD with ANDRITZ Automation!

Best regards,

W. Semper

Wolfgang Semper

“For decades, we have been integrating electrification and automation systems into virtually all of our deliveries.”



Innovative automation on a global scale

An interview with Gerhard Schiefer, Chief Automation Officer

Innovation seems to be an overused word – what does it mean to you at ANDRITZ Automation?

It seems like everything is innovative these days. Unfortunately, frequent use of the word has caused it to lose much of its meaning. The irony is that the NEED for innovation remains high among our customers, who are faced with ever-changing, competitive global pressures. They know that they have to do things differently (i.e. better).

“Innovation means being able to deliver higher-value performance, oftentimes using breakthrough technologies, in more manageable ways.”

For us at ANDRITZ Automation, innovation means being able to deliver higher-value performance, oftentimes using breakthrough technologies, in more manageable ways. It is difficult, if not impossible, to be innovative in a vacuum. So we work side-by-side with customers and research institutions to arrive at solutions faster and better that meet our customers' needs. R&D has been at the heart of ANDRITZ's technologies since its founding almost 170 years ago.

What are the main challenges ANDRITZ Automation is facing and how are you addressing them?

Our main challenge is to closely follow – and actually anticipate – the very dynamic needs of the industry sectors we serve. There are amazingly rapid changes, especially in the area of smart sensors, the Industrial Internet of Things (IIoT), and Big Data analytics. We address this challenge by being in constant contact with customers – especially the pioneers and

early adopters that we find in each industry sector. These are the people we want to know and have dialogue with.

Yet, we also know that the process industries are not adventurous. There is too much capital at stake, so risks have to be mitigated. Our challenge is to make sure that our solutions are balanced: HIGH in technology and performance and LOW in risk.

What are the key facts about ANDRITZ Automation that you would like customers to know?

That we provide automation services and solutions for a wide range of industries. That we offer a range of skills and services from pre-feasibility consulting, to estimates, to project management, to hardware and software engineering, up to plant simulation, optimization and commissioning on site. That we have more than 2,000 automation experts around the world in 110 locations. That we have a close connection with our colleagues in the Business Areas so that we integrate process + machinery + automation in a single interface to reduce commissioning, start-up, and optimization times and increase productive operating hours.

What good examples are there of innovative solutions at ANDRITZ Automation?

Our Metris system, Metris OPP contracts, and our network design using Edge devices are truly innovative. Not only are they technically elegant solutions – they are also very practical and offer a measurable return on investment.

The Metris solution is platform-independent and enables local control as well as plant-wide connectivity in a simpler, more elegant solution. Today, a classic, industrial automation network relies on a rather rigid hierarchy in order to operate. Optimization software is separate from this hierarchy, and the topology can be complex. The Metris concept combines the input/output, condition monitoring, and overall control. Unit level controls can be easily linked to perform machine automation or complete process automation. It is “configured” rather than “programmed” using a highly graphical, functional interface. Metris OPP (Optimization of Process Performance) combines Big Data analytical capabilities with our highly skilled process and equipment experts to perform a truly unique service. With Metris OPP, the vast amount of data generated by plant sensors and control systems becomes a valuable “raw material” for optimization. Metris OPP looks for data interrelationships and patterns that a human being with a spreadsheet could never uncover. Then intelligent algorithms create control models to exploit these patterns. The human experts verify whether the proposed modifications to the process and/or operating procedures will be effective.

Our Metris OPP team is creating an increasing number of mobile apps that address specific plant needs – to untether managers and operators from the control room. Supervisors can see alarms in real-time on their smartphones no matter where they are. Business managers have real-time production and cost data in hand. Maintenance technicians have logbooks, checklists, repair procedures, and other documentation instantly available for each asset they are observing. Information can be exchanged easily among team members or from one shift to another by smartphone.

ANDRITZ Automation

ANDRITZ Automation is a leading supplier of machines and plant control systems operating worldwide and with headquarters in Graz, Austria.

The ANDRITZ Automation services and tools provided cover a wide range of industries, such as pulp and paper, mining, or oil and gas. Customers around the world rely on ANDRITZ Automation, which has a total of 110 different locations, in various fields like pulp and paper, separation, stainless steel or food and beverages.

ANDRITZ Automation assists customers from project concept to execution and through-out operations, starting with pre-feasibility studies and front-end engineering of controls, electrical and power systems engineering and followed by estimating, scope development, and value engineering. This also includes project management, erection work,

start-up and operator training and continues with maintenance and engineering work for expansions and improvements. ANDRITZ Automation is the full capability controls, electrical and power system integrator, filling the roles from owner's engineer to S/MAC (Simulation and Main Automation Contractor), from small improvements to turnkey projects.

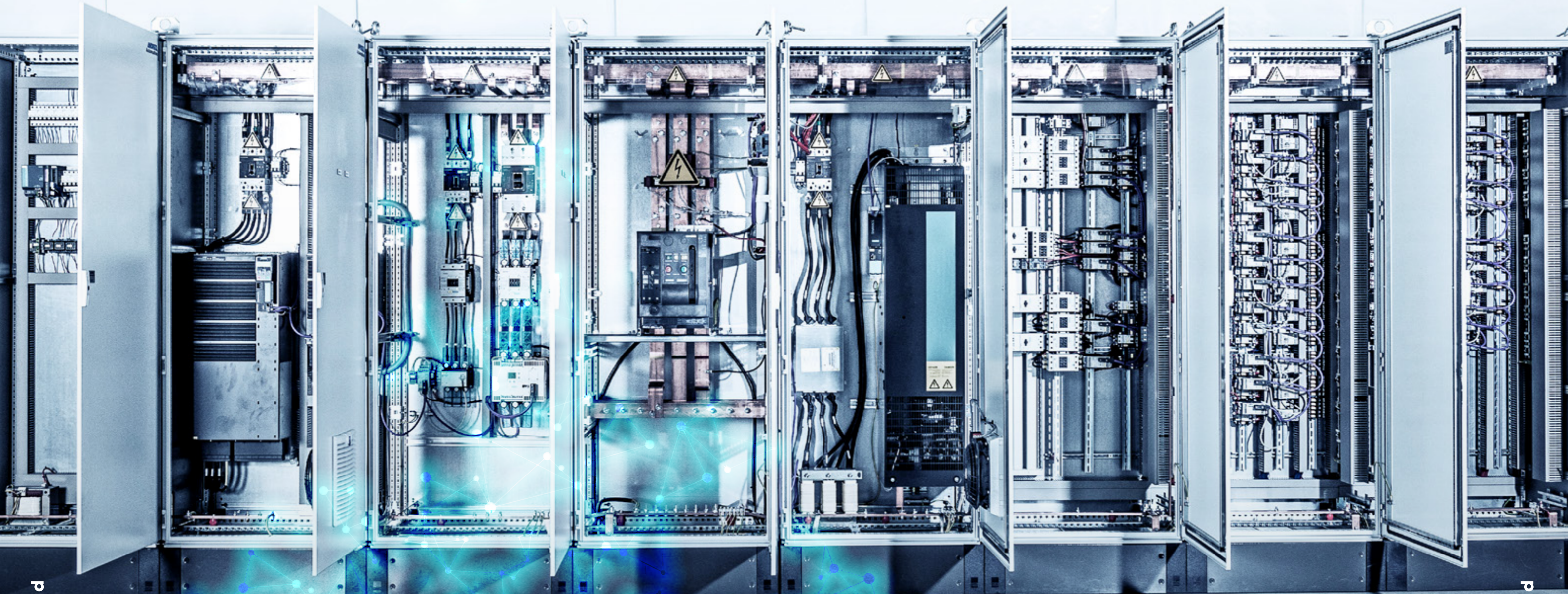
With plant control systems, simulation and advanced control tools, automation experts help plants to become operationally ready within a short start-up period through comprehensive process know-how and pre-tested components. The close cooperation between ANDRITZ Automation experts and all business areas within the ANDRITZ GROUP

consolidates the concentrated process knowledge that creates significant advantages and customer-focused solutions.

By investing in research and development, ANDRITZ Automation drives innovation and continually improves both processes and plants. The main goal is to raise the efficiency, sustainability and profitability of the plant and its processes while reducing costs and downtimes. •

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Hydro Automation



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ANDRITZ Hydro Automation provides innovative and competitive solutions for the complete secondary technology in power plants, thus covering the entire value chain: development, marketing, sales, engineering, design, commissioning, and after-sales service.

ANDRITZ Hydro Automation is an overall solution provider for secondary technology, its strengths being the provision of integrated solutions for all power plant subsystems: turbine governor, excitation, protection, control technology, as well as monitoring and diagnosis.

ANDRITZ Hydro Automation supplies solutions tailored to the customer's needs for large new plants in the Large Hydro business segment and highly standardized products in the Compact Hydro business segment. Rehabilitation of plants of all sizes mainly requires highly adaptable products and thorough process know-how. The NEPTUN concept, which is already in use in a large number of power plants, comes into its own throughout all applications. •

Pulp & Paper Automation

The pulp, paper and power plant automation department focuses on automation, electrification and instrumentation systems, helping mills to realize their full potential. The department serves the capital and service divisions on chemical pulp mill, power boiler, paper and tissue machine projects globally.

It supplies dynamic simulation, patented advanced control solutions and operator training tools, focusing on simulation, electrical and controls, operator training, and process optimization. Engineering specialists are mainly based in the product homes and are assisted by local support staff.

The dedicated products developed for the core equipment include electrification and control systems for stacker-reclaimers used for chip storage in woodyards, K4000 digester chip level measurement, the BaleMatic™ control system for bale finishing lines (automation, electrification and instrumentation), as well as the DryMatic™ dryer control system and safety related systems (SRS) for various process areas. Developments in digitalization, industry 4.0 and IIoT ensure constant further development. Maximum availability and advanced cyber-security standards and practices are key to enabling customers to use their equipment efficiently to produce pulp, paper, tissue, and steam for energy or district heat generation or methanol for biofuel. •



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ANDRITZ Metals supplies complete, integrated electrical equipment and automation solutions for the cold rolling industry. ANDRITZ Metals stands for state-of-the-art solutions in the metal industry and provides experts for electrical equipment and automation in every section of the processing line.

The core strengths are optimum project handling, based on well-engineered and process-optimized models from L1: PLC/HMI to L2: MES, and dealing with specified and application-oriented solutions. ANDRITZ Metals E&A engineering works with data-based CAE tools and is especially known for its experience in mathematical modeling. By introducing flexible and application-oriented automation technology together with standardized hardware and software systems, customers receive all-in-one electrical and automation solutions. •

Separation Automation

ANDRITZ Separation is the world's leading separation specialist with the broadest technology portfolio and more than 2,000 specialists in 40 countries. Industries ranging from environment to food, chemicals, and mining and minerals are benefitting from basic automation solutions and on to sophisticated technologies that recognize changes and imbalances within the production process.

The ANDRITZ Separation specialists use their in-depth expertise to provide scalable solutions that are individually tailored to regional and application-specific requirements, be this automation for new equipment or upgrades to prolong the equipment's life cycle. Customized upgrades, process optimizations, safety audits, and training complete the range of full services. With the aid of Metris addIQ control systems, plant performance can be enhanced measurably while keeping downtime to a minimum. As a supplier for cutting-edge automation technologies and digitalization, best-in-class performance is ensured. •



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Schuler



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Schuler is the technological and global market leader in the field of forming technology. The company provides presses, automation solutions, dies, process expertise, and service for the entire metalworking industry and for lightweight automobile construction.

Schuler's customers include automotive manufacturers and suppliers as well as companies in the forging, household appliances, packaging, energy, and electronics industries. Schuler is a leading supplier of minting presses and implements system solutions for a wide range of different high-tech sectors.

From the individual press to the complete press line, Schuler is a system supplier. Schuler automates forming lines with intelligence and an eye to practical utility. In this way, Schuler boosts a line's production performance efficiently and economically. Whether customers are looking for a broad portfolio of parts, high productivity or have a need for compact equipment, Schuler automation solutions win over customers with high efficiency and reliable production processes. Schuler also modernizes existing lines, while Schuler Service offers a tailored portfolio of services covering the entire equipment life cycle. •

EVENT

ANDRITZ Digital Solutions – Interdisciplinary competences in Automation, IT & OT



EXPERIENCE THE METRIS DIGITAL CUSTOMER JOURNEY

Metris technologies are the state-of-the-art outcome of the latest developments in the era of digitalization, IIoT and smart solutions. ANDRITZ incorporates its interdisciplinary know-how gained in several industries into digital solutions under the Metris umbrella brand. Experience a 3D-printed and digitally augmented machine in operation, connected to a control system with interfaces that allow every optimization potential required to also be used.

We will introduce you to predictive maintenance combined with smart services, scalable from a single machine to end-to-end solutions. The ANDRITZ team is looking forward to meeting you at our Metris booth at the Hannover Messe 2019. •

**HANNOVER
MESSE 2019**
APRIL 01 - 05

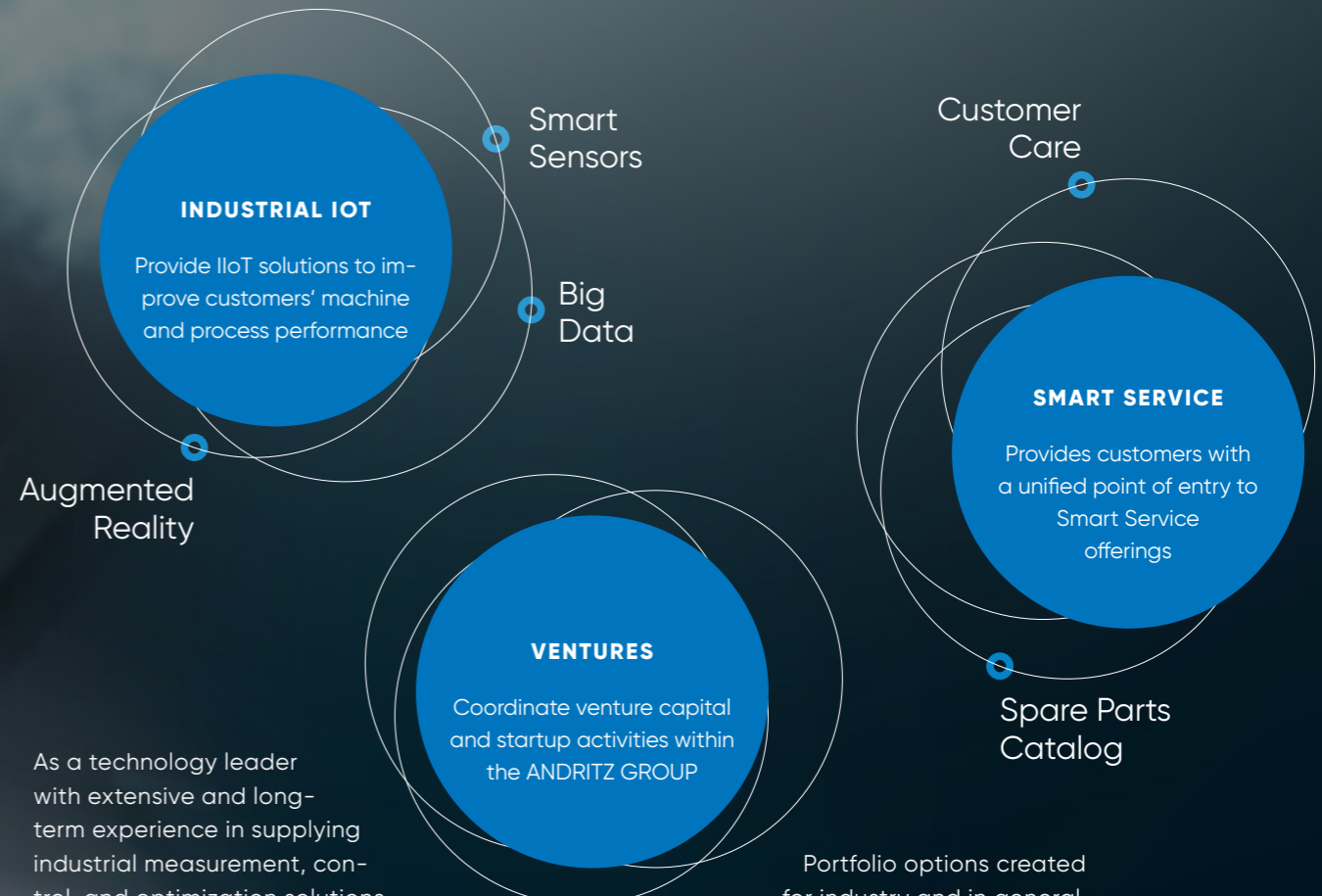
ANDRITZ Booth
Hall 6, E29



andritz.com/hannover19

Foresee digitally with Metris

Industrial IoT, Industry 4.0, digitalization – current buzzwords that industries use when seeking to improve their performance and equip themselves for the future of industry.



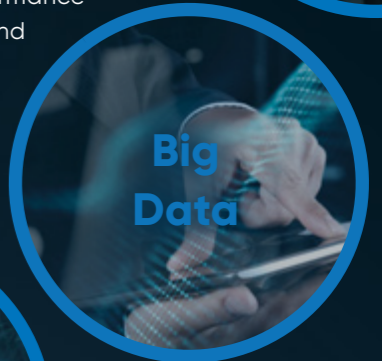
As a technology leader with extensive and long-term experience in supplying industrial measurement, control, and optimization solutions for various industries, ANDRITZ is combining its process and equipment expertise with the latest advancements in the digital era. The result of this powerful combination is Metris: a portfolio of ANDRITZ digital solutions.

One of the flagship capabilities of Metris is its ability to optimize industrial processes, known as Metris OPP. Metris OPP has been developed over the past decade and is installed today in over 50 locations around the world. It combines powerful analytical and data mining software with the knowledge of the world's top process experts to deliver a smart service initiative for customers.

The depth and effectiveness of the Metris portfolio continues to improve thanks to ongoing R&D, collaboration with key customers and institutions, and venture activities.

Portfolio options created for industry and in general as well as the specific requirements of key industries served by ANDRITZ all rely on the three strategic focus areas of the Metris brand: Industrial IoT technologies, Smart Service concepts, and Venture activities. The main technological advancements integrated into individual Metris products are derived from Big Data analytics, Smart Sensor technologies, and Augmented Reality solutions.

Metris helps customers to foresee digitally. With this forward slant, ANDRITZ is continuously improving the portfolio and its performance – providing tailored and fully integrated digital solutions from a single source. •



SOLUTION

Imagine the ability to produce the best product at the lowest cost every hour of the day – based on the current realities, constraints, and opportunities. That is optimization in a nutshell. Automation plays a critical role in achieving optimal performance and remarkable results.

Life is busy. We are all busy.

We often cram too many activities into our days – both at work and at home, to the point where it can seem chaotic. At work, we are stressed due to deadlines or meetings. In our spare time – especially with the rise of social media – we spend our “free” time staring at screens, texting and tweeting.

All this “busy-ness” and activity may give the illusion that we are living life to its fullest. Yet, inside, we feel that things are not in balance. Self-help gurus come to our rescue – giving us tools to “optimize” our everyday life.

The same can be true of industrial processes – all the “busy-ness” of flow rates, temperatures, pressures, speeds, inputs, and outputs. Yes, a certain chaos can ensue when things are out of balance.

The self-help gurus for industrial optimization exist as well. In most cases, they are much more effective at helping optimize a plant’s performance than the ones at the bookstore claiming they can help us get our lives back in order.

However, optimization is a tricky word. The key to optimization is to “get to the root” of what it means to be “optimal” for a given process. Is it consistent quality? Lowest cost? Highest throughput? Highest availability? Lowest equipment wear? Nevertheless, once this has been defined, there are automation tools, such as Metris OPP, that will adjust inputs/outputs in real-time to achieve optimal operations at any given moment.

Not a small task. But achievable.

PROVEN BENEFITS

Metris OPP (Optimization of Process Performance) is an ANDRITZ service, usually per-

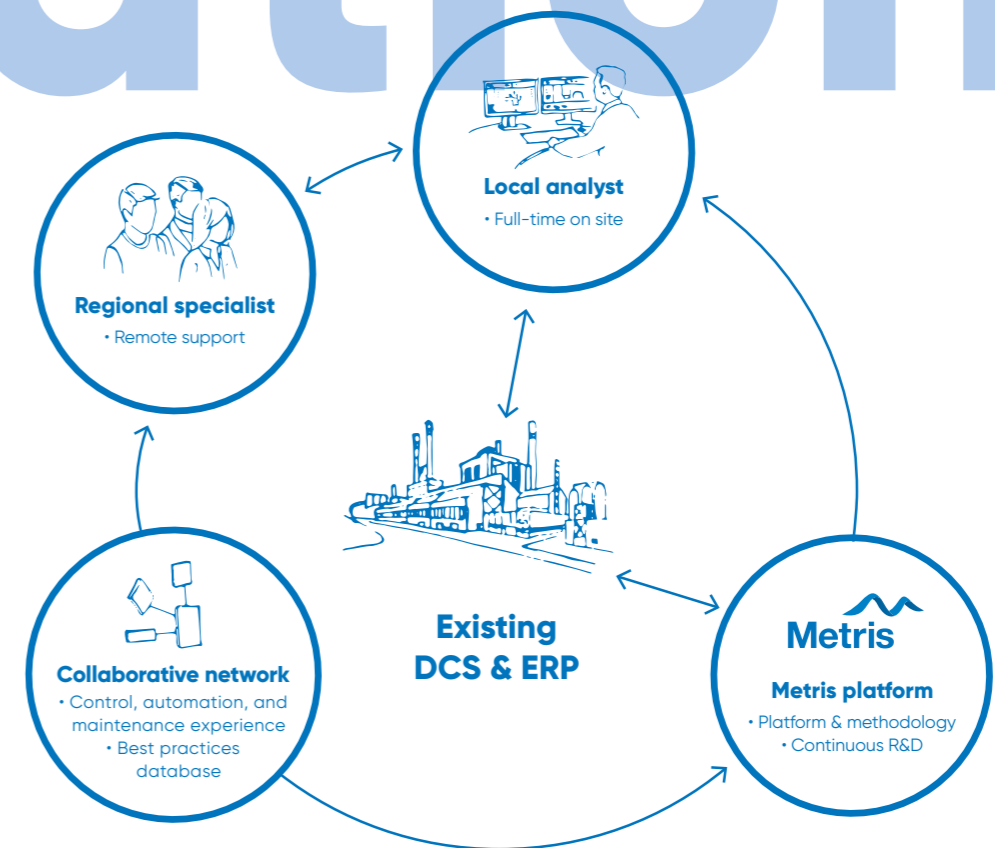
formed on a longer-term contractual basis, that improves the performance of a production system. Metris OPP has helped clients worldwide save millions, with pulp mills, steel mills and chemical plants among the industries that have reaped benefits in weeks rather than years.

Metris OPP is part of the Metris family of ANDRITZ Digital Solutions. It is based on continuous developments in the three main Metris technologies – Smart Sensors, Big Data and Augmented Reality – and improves production systems by analyzing a huge amount of data collected throughout the systems.

COLLECTING INFORMATION TO DELIVER RESULTS

How does Metris OPP work? The analytical software collects information from systems about each control loop, control valve, motor, and all the variables in the process. Sophisticated signal processing and statistical tools in the software identify control loops and assets that are not performing to the »

Optimization



optimum and predict the economic impact this will have on the process. Then human expertise takes over. ANDRITZ experts work with the customers' operations and maintenance staff to prioritize opportunities and make corrections. In some cases, it can be a simple fix such as repairing a valve. Others require analysis of the overall control objective and changing the process control strategy to eliminate off-spec production, overconsumption of chemicals and energy or sources of process variability. The result is increased operational stability and reduced waste.

ACHIEVE KPIS WITH THE HELP OF ANDRITZ

"Talk to those who can make you better than you are." – Seneca already knew that this strategy is a reliable way of triggering improvement and working towards achieving new goals. When using Metris OPP, a client can be sure of being heard. A customer-oriented workflow focused on individual targets and KPIs is crucial, like cost savings in production, reduced energy consumption or smoother long-term operation. As soon as the KPIs are specified, actions are taken to achieve the goal of improving the processes within the 3-month test phase. Under the basic pricing model, charges are only incurred once concrete savings have been realized. Both within the test phase and the following quarterly periods, the higher-level goals defined are analyzed, evaluated, and adapted if necessary. This approach always guarantees that the ANDRITZ experts and the customer all pull together.

GAINING INSIGHTS THROUGH DATA

Metris OPP can be compared with a tool kit and offers a variety of functionalities and apps. Tools such as the dashboard allow managers to gain a clear overview and access KPIs, balanced scorecards and project management tools. Engineers, on the other hand, can draw on OPP's powerful data analytics tools such as data mining, statistics and power spectral density to quickly implement any efficiency modifications.

ENHANCED DAILY OPERATION

OPP is an especially powerful aid for operators and shift supervisors, for exam-



ple with the Logbook. This stored user data can be utilized to enhance daily operations, find solutions to recurring problems, or train new operators. Smart controls and operator assistance facilitate an array of start-up sequences, diagnostics and root cause analyses as well as adaptive set-points, multivariable predictive controls and neural networks. Regulatory control functions include control loop tuning and assessment as well as dead-time compensators and feed-forward options.

REAL-TIME DATA AND AUGMENTED REALITY

Field operators and maintenance technicians can perform more effectively with on-hand, augmented reality support. Real-time data and diagnostics coupled with remote support allow improvements to be implemented as and when they are needed. OPP also has functions that allow a malfunctioning valve or motor to be adjusted or replaced before it has had any significant negative impact on production. •

OVER
50
CONTRACTS IN 14 COUNTRIES

OVER
50
MILLION EUROS SAVINGS PER YEAR

OVER
32
MILLION TONS OF PRODUCTION

OVER
200
EXPERTS WORLDWIDE

0

CAPITAL INVESTMENT

Benefits of Metris OPP

- Identifies opportunities for savings and efficiency enhancement
- Powerful signal processing and statistical analysis of control effectiveness
- Reduces off-spec production or wasted raw materials
- Increases production by enhancing process stability
- Better quality in end product – less variation
- Predicts failure in specific equipment and increases equipment availability
- No capital investment required; flexible payment can be based on savings achieved
- Field-proven model in many contracts in different countries
- Knowledge database continuously incremented
- Continual R&D



A self-operating mill? Big thinking and big results at

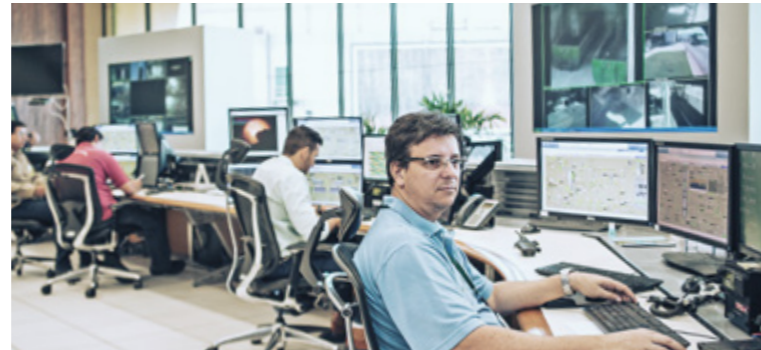
ELDORADO

FACTS
Company: Eldorado Celulose
Location: Três Lagoas, Brazil
Product: Bleached market pulp (1.7 million adt/a)
Automation tool: Metris OPP

Autonomous automobiles use a variety of techniques to gather data about their surroundings and feed this data to advanced control systems that interpret the inputs and identify appropriate navigation paths. The development of autonomous pulp mills using Metris OPP is following a similar path – and Eldorado Celulose is an early adopter of this technology. The results have a big economic payback.



Experiments began with automated operation back in the 1920s or even earlier. The first truly autonomous cars appeared in the 1980s. The development of autonomous mills is moving at a much faster pace thanks to smart sensors and tremendous computing power in small packages that are part of ANDRITZ's Metris OPP (Optimization of Process Performance).



The control room at Eldorado is the action center for production control. OPP software resides in the DCS for advanced control of fiberline processes and also links process, maintenance, and asset management information into one network.

Metris OPP is a combination of sophisticated software and knowledgeable human experts. This system is aimed at improving production through data mining and control strategies, with the goal of reducing costs and increasing profits. It has been around in various forms for over a decade and is constantly evolving and improving. Metris OPP has been implemented in over 50 plants in 14 countries. Arguably the most impressive Metris OPP project is the autonomous mill at Eldorado Celulose near Três Lagoas (MS), Brazil.

"I can tell you this. The results in the first year have been impressive!"

Carlos Monteiro,
Industrial Director, Eldorado Celulose

do. "Most of our work at Eldorado to date still has an operator in the driver's seat, so perhaps 'automated mill' more accurately describes what we are doing today – with an eye towards autonomy in the future."

Carlos Monteiro, Eldorado's Industrial Director, does not care whether it is autonomous or automated. Monteiro is focused on results.

AUTOMATED OR AUTONOMOUS?

"Autonomous implies acting independently," explains Leonardo Soares Figueiredo, ANDRITZ's OPP Project Manager at Eldora-



Arthur Santos, ANDRITZ OPP Analyst (left), gives a progress update to Carlos Monteiro, Eldorado's Industrial Director, while touring the fiberline. According to Monteiro, OPP has made a "big difference" in Eldorado's performance.

"I can tell you this," he says. "The results in the first year have been impressive."

An increase in operational efficiency from 89.2 to 93%; variable cost reduction of 7%; 38,000 admt production over the budgeted amount; AND controls in automatic mode 95% of the time.

METRIS OPP

Increasing operating efficiency by 3.8% may not sound like a tremendous improvement. But in a mill currently producing 1.7 mill t/a – that amount is equivalent to millions of Brazilian real in the end. The fact that Eldorado operates sustainably at 13% above design capacity without any additional capital investments is proof of its efficiency.

But why would a mill already operating in the top tier choose a service like Metris OPP? "We are well-managed and have tight cost controls," says Leonardo Pimenta, Technical Control Manager at Eldorado and in charge of the OPP project. "But we can always improve our position. We focus on every detail to stay ahead of our competitors. Metris OPP is a tool that helps us stay ahead."

STEP-BY-STEP TRANSFORMATION

The high level of automation at Eldorado didn't come over night. All changes within the processes of the mill were and are done step-by-step and executed on a daily basis. The advantage of this approach is seen in

"Metris OPP is a tool that helps us stay ahead."

Leonardo Pimenta,
Technical Control Manager, Eldorado Celulose

the smooth, gradual integration of the process improvements without impacting daily mill routines.

"The main challenge was never the engineering itself, but rather the adjustments required in the way that operators and managers worked," Figueiredo says.

"The key to us achieving results is the belief that processes are better controlled by automatic, advanced process control than by manual operator intervention," says Pimenta. "Stability is essential. Every loop in automatic mode makes us money."

KPIS ARE MEASURED CONSTANTLY

"There were pretty high targets, especially for a well-run mill," Figueiredo admits. "But we were committed – both Eldorado and us – to achieving them. We signed an agreement in August 2016 with the idea that we would have all the front-end work done by the end of the year so we could start measuring results in January 2017."»



Early in the project, Eldorado and ANDRITZ set clear goals against which to measure success. These goals, known as Key Performance Indicators (KPIs), form the basis for 30% of ANDRITZ's payment, so they are important. What gets measured gets done.

The three KPIs selected as being most critical are: 1) operational stability in the 90-93% range; 2) a reduction in variable costs versus budget; and 3) all the APC routines will be turned on at least 90% of the time.

Arthur Santos, OPP Technical Specialist at ANDRITZ, believes that the front-end work of analyzing control loops and then "tuning" each loop is responsible for helping achieve the results Eldorado is seeing today. "It all starts with reliable data, which comes from reliable instruments and sensors," Santos says. "We completed over 40 projects using combinations of smart sensors, APC, loop tuning, data mining, and so on that created the infrastructure and a standardized way of operating."

ALMOST 100% AUTOMATED CONTROL

Today, the Eldorado mill runs in automatic mode 97-98% of the time, enabling Eldorado to progress from basic control to "hands off" and even "eyes off" operation. However, operators mostly still start and stop the production process and take over when malfunctions or breakdowns occur, which accounts for the remaining 2-3% of control tasks.

For the rest of their shift, operators can safely turn their attention away from mundane control tasks. "By running in auto, we can re-assign operators to more highly leveraged tasks," Pimenta says. "If you think about it, even the best operator in the world can't



Tiago Garcia (Utilities DCS Operator), Douglas Freitas (Power Boiler DCS Operator), Adriano Cabral (Automation Analyst) and José Spadon Jr. (Fiber Line DCS Operator)

In less than one year, some important milestones were achieved: a new record for quarterly production from January to March; a new monthly production record in May; a new quarterly production record from April to June; and in August a new average production record.



Eldorado Celulose's senior management team (left to right): Luiz Roberto Araujo, Maintenance; Marcos Steyer, Woodyard and Chip Preparation; Murilo Sanches, Recovery, Utilities and Energy; Leonardo Pimenta, Technical Control Manager; and Marcelo Martins, Production Manager.

be alert and on-duty 24/7/365.

AUTOMATIC START-UP SEQUENCES

At the bleach plant, an automatic start-up sequence has been implemented and tested. "The operators only have to press one button, and the plant starts up by itself," Santos says. "After the process has started, Metris OPP takes over to control bleach production. The



expansion of this sequence within our autonomous mill has reaped tangible rewards already, which is why we are now developing similar start-up control for the washing processes."

SUPPORT FOR RISK-BASED MAINTENANCE

Three reliability engineers are part of the ANDRITZ-Eldorado team working on the Metris OPP project. According to Luiz Roberto Araujo, Eldorado's Maintenance Manager, these three are supporting the mill's culture of risk-based maintenance (RBM) by centralizing information from the process and the equipment in the same database.

It sounds simple, but the amount of work is quite challenging. ANDRITZ OPP analysts have tapped into the mill's SAP maintenance planning software to retrieve vital information on Eldorado's 23,000 assets in the database and combine this with process info from the DCS. The whole team is working on making this communication between the databases mutual.

"This gives us a new level of knowledge about our assets," Araujo says. "Understand-

ing the process is fundamental to understanding the health of our mill. Identifying the risks early prevents unplanned stoppages." Each asset has been categorized A, B, C, or D, depending upon the critical importance of the equipment to the mill's operations. "We monitor the risks for each asset and focus our attention on the highest-priority risks to our most critical assets," Araujo explains. "One glance at a computer screen shows us where to focus our efforts to avoid unnecessary shutdowns."

The result? "We're operating at 95% overall equipment availability," Araujo says. "That is an excellent result."

METRIS OPP MAKES A BIG DIFFERENCE

According to Monteiro, Metris OPP has made a "big difference" in Eldorado's performance. "We have achieved excellent results in just a short time," he says. "Every loop in APC makes us money. Selfishly, I would prefer if no other pulp mills were to investigate Metris OPP. But even if there are some who do, we intend to keep pushing and to stay ahead." »

"Metris OPP has made a big difference in Eldorado's performance. In a short time, we have achieved excellent results."

Carlos Monteiro,
Eldorado's Industrial Director



"I suppose there are some people who believe that the Industrial Internet of Things (IIoT) is just a marketing gimmick," says Daniel Schuck, Vice President of Technology for ANDRITZ APO. "Maybe they said the same thing about transmitters and the early distributed control systems. But what we are doing is not pie-in-the-sky fantasy. We are using new tools to do traditional things – saving mills millions of dollars a year."

"We might have tried to do some of this alone, but we chose to bring in an experienced partner with ANDRITZ," Pimenta says. "They have the tools and the experience to help us reach a much higher level of performance faster. Our results show that there is a lot to be gained by extracting the hidden capacity from our assets before having to make additional capital investments."

ONGOING PROJECTS

Another project is currently underway to determine the best production mill balance at any given time. "Think of it as level control for the entire mill," says Santos. "We are writing software to monitor all the tank levels in the mill and combine this info with key process variables. This software will be crucial in achieving a higher level of autonomy of the mill because then we will have a powerful tool that will manage production throughout the mill using real-time data."

The mill is also working on an Augmented Reality project to help maintenance staff obtain instant information in the field simply by looking at a piece of equipment with Aug-

mented Reality glasses. At the moment, Eldorado has made considerable progress in making checklists available for operators and maintenance people on their mobile devices.

In addition, there are Metris OPP projects to optimize ash leaching, dissolving tank TTA, lime kiln energy efficiency, and other control strategies being developed. Creation of machine learning tools, automated data analytics to predict process disruptions, and two-way-communication between Metris OPP and the SAP software of the mill are also in progress.

"PUT ALL OUR EFFORTS INTO THIS"

There are various "flavors" of Metris OPP in various plants. The one thing they have in common is that the work is performed in collaboration with mill personnel – operators, technical resources, and management. Eldorado is unique in that a joint team was formed – ANDRITZ and Eldorado personnel – from the very beginning and works together every day.

"You can find Eldorado process and maintenance reliability engineers and ANDRITZ OPP analysts in the same room," Santos says. "We interact constantly, collaborating and


solving problems together."


"We have put all our efforts into the success of this project," Monteiro says. "I don't think there are other mills working this way with a team of committed resources on a full-time basis."


According to Pimenta, when Eldorado decided to go with OPP, it did so in a big way. "We chose to apply all the concepts and all the technologies that OPP offers at the same time," he says. "We didn't want to do it in pieces, but all at the same time and as quickly as possible. That's the Eldorado way." •


Leonardo Pimenta, Technical Control Manager, meets with the OPP team to discuss progress. The team consists of Eldorado process engineers, reliability engineers, and ANDRITZ OPP analysts working side-by-side.

FOUR FACTS


98%
AUTOMATIC MODE


+3%
OPERATIONAL STABILITY


**AUTOMATED
START-UP
SEQUENCES**


7%
REDUCTION OF CHEMICAL
AND ENERGY COSTS

Drawing conclusions from data: the Datalytic Team @ work

An interview with Everton Rocha de Souza, Coordinator of ANDRITZ Automation's Datalytic Team

WHAT IS THE MAIN FOCUS OF THE DATALYTIC TEAM?

Manufacturing plants generate a lot of data within their instruments, distributed control systems, laboratory and business systems. Most of the data is used as a "snapshot" to take a controlling action or similar. Few plants have an efficient, practical way to sift through the data they generate and make sense of it in the longer term.

The Datalytic Team provides these tools – the ability to efficiently track, store, filter, and visualize a plant's data. We discover data relationships and patterns that a human being with a spreadsheet would never uncover. When these are presented to an experienced process expert, decisions can be made to run the plant more profitably. Then we help customers develop models so that these decisions can be automated and integrated into operations.

WHAT RESULTS HAVE BEEN OBTAINED SO FAR?

The results are primarily faster and more profitable decision-making – things like faster start-ups, less downtime, and incremen-

"At some mills, we have more than 70,000 variables in the system. We never know which might be of most value to solve a particular problem, so we have a powerful system to collect, track, and analyze data."

Everton Rocha de Souza



Datalytic Team Graz from left to right: Paul Schneeweiss, Christoph Aigner, Everton Rocha de Souza, Günter Jaritz, Zohil Villa-Carreno, Jaime Pinheiro and Lauri Salminen (missing in the picture)

tal reductions in the consumption of chemicals, energy, and so on. One of the intangible results is the teamwork this approach encourages, bringing data scientists and process experts from ANDRITZ together with the plant's operating, maintenance, and technical personnel – all with a common goal.

WHAT ROLE DOES METRIS PLAY?

Our Metris platform provides a bridge between the types of expertise required – Big

Data analysis tools, automatized analysis and data visualization. It supports the evolution from purely physical information (flows, temperatures, pressures, basis weights) to the desired state of adding intelligence to the data. Unlike us humans, Metris is not overwhelmed by massive amounts of data. The longer data is collected, and the more data is collected, the more the system learns – which is the basis for Artificial Intelligence (AI) and Machine Learning (ML) technologies. •

EVERTON ROCHA DE SOUZA

is an electrical engineer and is currently taking a Master's degree in Data and Information Science. With experience as an operator for the Brazilian pulp producer Suzano S.A., he joined the Automation department in Graz in 2011. After planning safety systems for pulp mills, programming distributed control systems and handling Metris OPP contracts in Europe, he has been coordinating the Datalytic Team since 2016.

Everton Rocha de Souza explaining data visualization in the new Metris Performance Center.



With the need to verify designs, check out automation equipment prior to installation, improve operational efficiencies, comply with stringent safety standards, or thoroughly train operators in a virtual, safe mode prior to a major start-up, process industries are relying increasingly upon dynamic simulation to extend and expand their efficiencies.

EXPANDING HORIZONS

Process simulation was a fledgling technology in the early 1980s, but has grown to its current position of primacy, aided by Moore's law of predicted accelerated growth in computing power. IDEAS™, a proprietary simulator from ANDRITZ, has been catering to the high-fidelity simulation needs of the pulp and paper, mining and mineral processing, power, and oil sands processing industries for the past three decades.

OPTIMIZED OVERALL PLANT DESIGN

The dynamic simulator IDEAS optimizes overall plant design for flowsheet, equipment, capacity and performance alternatives. As a project progresses, ANDRITZ Automation experts build a "Digital Twin" of the plant. This Digital Twin is a fundamental aspect of a cyber-physical system – one of the basic pillars of Industry 4.0 – and is closely integrated with artificial intelligence and advanced analytics.

IDEAS mitigates project risks and shortens actual ramp-up up time by checking, revising, and validating the P&IDs, operability, and process control logic before start-up. »

The Digital Twin in the IDEAS simulator is connected to the customer's control system so that operators can be fully trained in all the start-up, shutdown, and operating scenarios in a virtual, safe mode. So when the plant is actually started up, the operators are already in a position to achieve the capacity, performance, and reliability goals expected and the project becomes an outstanding success. There are dozens of documented examples of world record-breaking start-ups and ramp-ups achieved with the assistance of the IDEAS simulator.

In operation, IDEAS models are connected to real-time data in order to be executed parallel to the process. Real-time execution of the Digital Twin allows the creation of new applications and capabilities in the customer's system, such as building virtual instrumentation, deploying condition monitoring systems, and performing real-time optimization.

MEETING INDUSTRY NEEDS WITH CUTTING-EDGE UPGRADES

Continuously revitalized with feedback and cutting-edge ideas from a global team of scientists and engineers, IDEAS is constantly evolving into newer, more powerful versions. For example, IDEAS is used extensively to model thermo-hydraulic and electrical networks in power generation plants. The simulation of supercritical boilers poses inherent challenges in two major areas – stability of the solution and speed of convergence. The upgraded, thermodynamic property correlation solving techniques in IDEAS 6.5.0 – the current version in release – allows faster convergence and enables real-time solving, which is a characteristic essential in operator training simulations and model-based tools to support operations in real-time.

The new version also allows users to run multiple models in a segregated or modular arrangement. A single instance of the IDEAS application can now seamlessly host multiple models, while each model can be linked to the DCS with an independent communication host through the OPC framework. Users report improvements of up to 100% in the model speed execution thanks to



upgrades to the development platform of IDEAS' dynamically linked libraries with code optimizations.

ELECTRICAL POWER NETWORKS AND DATA ANALYTICS

IDEAS includes objects for modeling electrical load networks such as generator, grid, transformer, buses, breaker, and plant load units. The electrical solver simulates the power balance and load flow distribution in the network with a real-time response to the dynamics of the plant, such as start-up and load variations in the process.

The process units and the electrical networks can be integrated into a single monolithic model and solved simultaneously. Additionally, the functionalities of R-language and Python are invoked through the External Code Interface object. In the current era of Industry 4.0, computationally intensive data analytics and machine-learning algorithms are rendered viable for practical applications – thanks to the ascendancy of computing power. A computationally superior platform is already being developed and is set for release in 2019. •

New features in IDEAS

Strengthening the core	New avenues
Thermodynamics enhancements	Electrical product
Multiple models	R-language and Python interface
Speed improvements	

The Smart Press Shop

Schuler's answer to Industry 4.0



At the Hot Stamping TechCenter in Göppingen, Schuler is currently conducting a field test on condition monitoring.

Like many other manufacturers, producers of discrete parts using metal forming presses face new challenges in terms of higher efficiencies, higher quality, and reduced waste. This is especially evident in the automotive industry – both for automobile manufacturers and suppliers to this industry. Schuler is responding to these challenges with solutions based on Industry 4.0 criteria: the Smart Press Shop.

In the intelligent and fully networked press shop of the future, it will be possible to predict potential downtime accurately with the aid of data collected from sophisticated sensors and actuators, and to avert this downtime well in advance. Removing disturbances and unplanned downtime will not only increase a plant's productivity. It should also increase the quality of the parts produced while minimizing waste and energy requirements.

The Smart Press Shop from Schuler, which is part of the family of Metris industrial IoT solutions, delivers improved reliability and increased cost-effectiveness within the forming technology sector. The system is suitable for use with both new and existing equipment.

MACHINE MONITORING SYSTEM

At the heart of Schuler's digital toolkit is its Machine Monitoring System (MMS). There are

six functional modules making up the MMS: Monitoring of Overall Equipment Effectiveness (OEE), Track & Trace, Process Monitoring, Condition Monitoring, Power Monitoring, and Smart Diagnostics. These modules collect, analyze, store, and evaluate production processes and machine conditions. The MMS can be ordered with new machinery from Schuler or retrofitted to existing machinery. In addition, the communications interface is very flexible: directly at the machine or via a plant network -- and in the future also from the cloud.

"The digital transformation of the press shop is well underway."

Domenico Iacovelli,
CEO Schuler

A new Schuler press, the MSP 400 servo press, features process monitoring integrated into the control unit that ensures overload protection across the entire path of the pressing force profile. Under development is the capacity to integrate additional sensors (e.g. for acceleration, oscillation, or pressure) in order to enable comprehensive system condition monitoring and prevent unplanned downtime. In addition to productivity improvement, the process and condition data for each part produced will provide a basis for full quality control.

COMPLETE DOCUMENTATION

Schuler has also already demonstrated its ability to fully network different production facilities with its systems used by customers who manufacture train wheels. Among other things, this process requires data that is suitable for determining and increasing the overall equipment effectiveness (OEE Monitoring). This data is gathered by the system so that a quick glance is all it takes for the production manager to determine the total number

of parts produced, how many of these parts are acceptable, and which shift had the best performance.

The data collected also serves as a basis for functions like Track & Trace of safety-related parts. The system links these parts to information on the initial material used and the material's origin, the system's lubrication and drawing force, and other production conditions. All of this makes it possible to provide a complete trail of documentation in the event of quality-related complaints (Process Monitoring).

"The digital transformation of the press shop is well underway," says Domenico Iacovelli, Schuler's CEO. "Major automakers and medium-sized suppliers can use the Smart Press Shop to achieve more efficient production and have fewer rejected parts. This helps them create and maintain the competitive edge they need." •

At EuroBLECH in Hanover, Schuler presented the new MSP 400 servo press with the Smart Assist operator software.



Performance at a higher level: new Metris Performance Center now in operation

ANDRITZ's new Metris Performance Center is designed to provide digital service and support for paper, board, and tissue mills around the world based on a real-time connection between ANDRITZ and each customer.

With the Metris platform connected remotely to the mill's DCS for analysis and optimization, ANDRITZ process and equipment experts in Graz, Austria, can be virtually at the side of any customer needing help with start-up, troubleshooting, loop tuning, or optimization of process machinery.

"We know that strong customer support is of utmost importance in any mill," says Klaus Blechinger, Vice President for Tissue at ANDRITZ. "With the Metris Performance Center, we can offer support to our customers from our company's best experts exactly when the customer needs it. No delays or high costs for travel, we are able to react quickly and efficiently."

The services at the Metris Performance Center are especially valuable during a start-



The Metris Performance Center is located at the ANDRITZ headquarter in Graz, Austria.

up, as customer personnel and ANDRITZ start-up engineers on site have real-time access to the top experts for machinery, process, and automation as needed. For example, if there is a problem with auxiliary equipment (e.g., a pump or some stock prep equipment), the ANDRITZ expert can quickly join colleagues in the Metris Performance Center to help provide a solution.

Another advanced service is the ability to collect digital information remotely from the DCS in order to apply Big Data analytics to optimize production processes or provide decision support to mill personnel. "Digitalization plays a ma-

major role in all our business areas, and we want our digital assets to be agile in the face of rapidly changing market demands," says Gerhard Schiefer, Vice President for Global Automation. "The Metris

platform makes this possible and allows us to provide smart services along the digital value chain of a paper mill. It offers features tailored to each customer's preferences." •

The center offers:

- Optimization of Process Performance (OPP) with Metris by combining the latest technology insights in digitalization with in-house process experience
- Process knowledge and specialists in production start-up support as well as implementation of new control philosophies
- Direct customer contact and faster response by online, real-time sharing using the latest communication and augmented reality (AR) tools
- Remote support for stable and economic process conditions in case of any process and equipment issues for customers worldwide
- A training center for workshops and trainee programs for internal and external employees, i.e. special troubleshooting courses for operators and process engineers



ANDRITZ Hydro will provide the instrumentation and control equipment at five hydropower stations on the Inn River.

NEPTUN system to be delivered for five run-of-river power plants

ANDRITZ Hydro's NEPTUN system is a comprehensive solution for controlling hydropower installations. The systems include excitation and turbine control as well as modules for monitoring and diagnosis, protection, synchronization, and overall power plant management.

The latest customer to order a NEPTUN automation and control system, which will be fully networked, is the Austrian-based utility VERBUND AG, which acquired 14 run-of-river power plants from E.ON of Germany.

NEPTUN systems will be installed at five of the plants on Germany's Inn River. Installation will be completed by 2021. The five stations are equipped with a total of 21 Kaplan turbines (master units), two Kaplan bulb turbines, and 19 gates. ANDRITZ will provide the instrumenta-

tion and control equipment (automatic control, mechanical protection), the governor and its hydraulic oil units, the excitation system based on HIPASE, and a complete replacement of the transducers. The new instrumentation and controls will allow fully automated operation, with the governors ensuring optimum efficiency and maximum energy yield thanks to their Adaptive Cam Control (ACC) and redundant water management automation. •

Modernizing the equipment and automation at FRIPA

The Bavarian tissue producer Papierfabrik Albert Friedrich (FRIPA) recently selected ANDRITZ to expand its stock preparation plant and integrate control of the new equipment into an existing control system. The scope requires modernization of the existing operating stations and servers.



ANDRITZ Automation will compile flow sheets of the existing plant sections, update the instrument lists for previous rebuilds, produce supplemental screen displays,

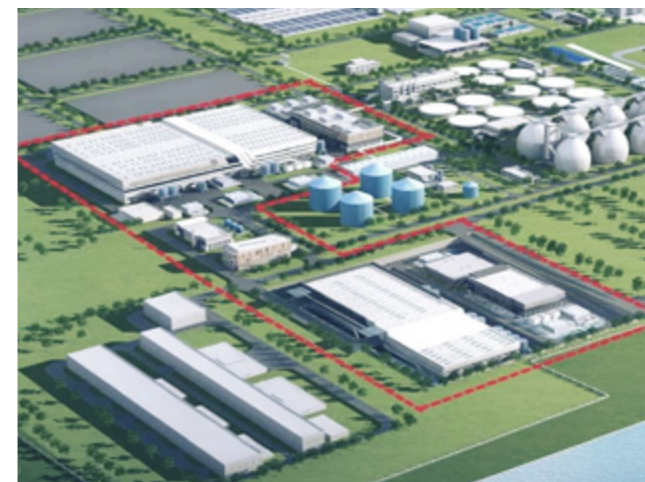
and compile logic diagrams after finalizing the functions with the mill. Services such as software testing, start-up assistance and delivery of the field instrumentation

are also included in the scope of supply.

The special challenge is to plan a new operating logic and control routine for the modernized stock preparation plant even though some of the documentation has been lost over the years. Existing equipment from a stock prep line that was shut down will be moved to the PM5 line and a screening plant will be modified to now handle the processing of broke. The logic and screen displays on PM5 will be de-

signed to be consistent with the displays implemented in the ANDRITZ PrimeLineCOMPACT machine (PM6) installed in 2008. This uniformity will make it easier for an operator to start and stop the machines in just a few steps. After completion of the programming work in April 2019, start-up is to follow in May. •

ANDRITZ Automation technology installed in Asia's largest effluent treatment plant



A strong move towards digitalization

On the equipment side, ANDRITZ will supply a complete drying and incineration system for expansion of the Bailonggang wastewater treatment plant in Shanghai, China. Construction started at the end of 2018, with first firing expected by the end of 2019 for one of the world's largest effluent treatment plants and the largest in Asia.

ANDRITZ Automation in China will supply the detailed engineering, electrical and automation systems engineering, and installation services (installation supervision and commissioning) as well as the DCS system, MCC control cabinet, and cabling for this massive project. •

Functional safety

Creating safety for high-end technology solutions

When designing machinery, planning a new plant, or optimizing existing facilities, all reasonably foreseeable hazards have to be identified and evaluated in a HAZOP (Hazard and Operability) and/or risk assessment. By doing this, potential threats are minimized with the help of a safe mechanical design and additional technical measures.

One of these additional technical measures is functional safety.

Functional safety is defined as the absence of unacceptable risks due to hazards caused by the malfunctioning of electrical, pneumatic, hydraulic or electronic systems. Hazards caused by malfunctions in electrical, pneumatic, hydraulic or electronic systems may include:

- Errors in specification
- Implementation or realization errors
- Failure during operations
- Reasonably foreseeable operational errors
- Reasonably foreseeable misuse



There are ISO and IEC standards that share a risk-based approach to establishing functional safety systems and assessing safety risks over the lifecycle of the product.

functional safety



FUNCTIONAL SAFETY LIFECYCLE

In order to prevent an accident, the design, engineering, manufacturing, assembly, and start-up have to be documented and verified in line with international and local regulations and with recognized technical rules.



At ANDRITZ, this applies to paper, board, tissue or pulp making and finishing machines, for example, boiler and exhaust gas cleanings systems, machinery and plants for steel forming and treatment systems, machinery for the feed and food processing industries, hydro-power plants, and safety functions in control systems.



Meeting requirements and reducing potential risks to a minimum is the overall goal that must be achieved. Moreover, functional safety does not deal with hardware alone. It focuses on software solutions and ensures that safety-critical processes are controlled better, faster, and more easily. Functional safety covers the entire lifecycle of a machine or product to ensure that it has a long-term und sustainable impact on the plant's performance.



There are several consequences when safety is neglected. Besides financial and legal damage, a company can tarnish its reputation. ANDRITZ Automation attaches extremely high importance to the functional safety of its products, offering high-end technologies that are also safe to own and operate.



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