DIGITAL TRANSFORMATION FORUM FOR THE STEEL INDUSTRY

14–16 MARCH 2022
The Westin Indianapolis • Indianapolis, Ind. USA

UPCOMING EVENTS

Sheet Processing and Finishing Lines – A Practical Training Seminar
20–23 March 2022
Sheraton Indianapolis City Centre Hotel
Indianapolis, Ind., USA

The Making, Shaping and Treating of Steel: 101
5–6 April 2022
Sheraton Birmingham Hotel
Birmingham, Ala., USA

28th Crane Symposium
20–22 June 2022
Hyatt Regency Milwaukee
Milwaukee, Wisc., USA

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ABOUT THE PROGRAM

The digital transformation (DT) journey continues to be a critical component for all steel companies. The 2022 Digital Transformation Forum for the Steel Industry will build on the success of the preceding forums and incorporate suggestions from attendees. Presentations on how machine learning works under the hood, change management and cultural challenges of implementing DT solutions, and additional panel discussions on actual use cases will be provided. In addition to machine learning and artificial intelligence topics, the forum will cover the importance and techniques for cybersecurity; the use of DT solutions for environmental and health and safety applications; practical uses of simulation, including augmented and virtual reality; and innovative uses of robotics. The essential roles that humans play in successful DT journeys will again be featured. These discussions include developing companywide initiatives, data visualization, self-serviced analytics and other aspects of human interaction.

WHO SHOULD ATTEND

Decision-makers and those with a technical background who are interested in learning more about how to make their areas smarter by utilizing digital transformation methods.

ORGANIZED BY

AIST's Electrical Applications and Digitalization Applications Technology Committees.

PROFESSIONAL DEVELOPMENT HOURS

This course may qualify for up to 15.5 Professional Development Hour (PDH) credits. Each attendee will receive a certificate listing the quantity of PDH credits earned for this course. This course is not approved for PDH credit in New York, Florida, North Carolina and Oklahoma.

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Visit AIST.org/byoyp for more information.

REGISTRATION INCLUDES

Reception Monday and Tuesday, breakfast and lunch Tuesday and Wednesday, and online access to presentations.

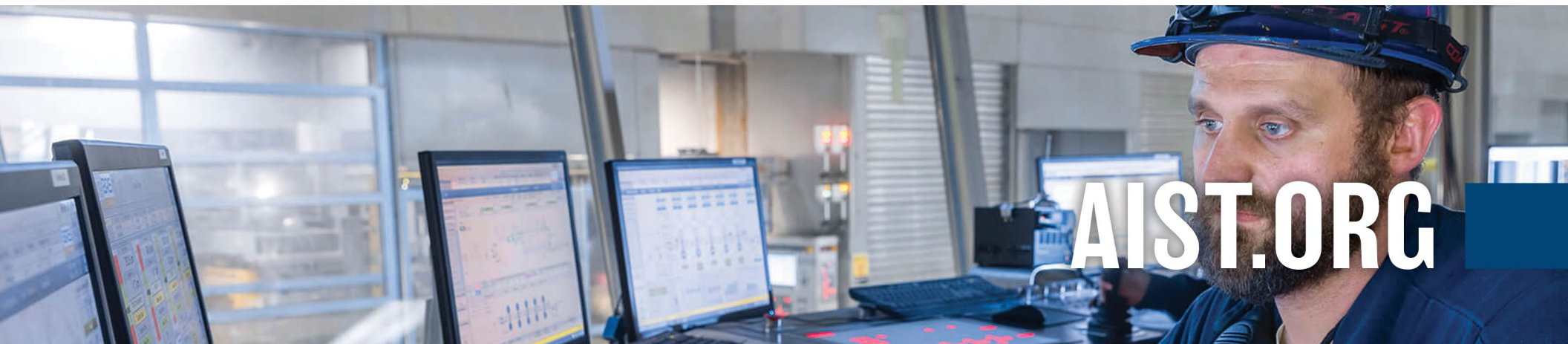
HOTEL ACCOMMODATIONS

A block of rooms has been reserved at The Westin Indianapolis. Please call the hotel at +1.317.262.8100 by 21 February 2022 to secure the AIST discount rate of US$165 per night for single/double occupancy.

ATTENTION NON-MEMBERS

Non-member registration fees include membership in AIST through 31 December 2023. Membership is not automatic. A completed membership application must be returned to AIST.

AIST MEMBERS	NON-MEMBERS
US$1,045	US$1,290



SCHEDULE OF EVENTS

Monday, 14 March 2022

4–6 p.m.
Registration

5–6 p.m.
Welcome Reception

Tuesday, 15 March 2022

7 a.m.
Registration and Breakfast

8 a.m.
Opening Remarks

8:10 a.m.
Keynote Lecture
Antoine Dhennin, ArcelorMittal

9 a.m.
Application of Highly Specialized Database Technology Within a Unified Data Landscape
Michael Peintinger, Smart Steel Technologies GmbH
Unification of the plantwide data landscape and overcoming data silos is a major challenge for steel producers. Modern technologies, e.g., machine learning (ML) and artificial intelligence (AI), promise huge benefits but require specialized high-performance databases to unleash their full potential, adding complexity. This presentation will focus on a data platform that aggregates and validates data from all sources in an integrated steel mill and stores data in specialized databases depending on the type and usage. This includes relational databases (scalars, genealogy), columnar online analytical processing (OLAP) databases (time series), a dedicated vector database (features), as well as low-cost media storage (images and video). Any transformation occurring during the production process is stored during data aggregation to allow full material tracking and data transformation depending on the reference point. A universal data provisioning layer on top of the actual database systems allows users to access data easily through a unifying SQL interface. An application programming interface (API) exposes functions to access the data programmatically. Multiple systems can be linked together to facilitate data exchange between multiple production sites. By data validation, the value of stored data is significantly increased and by a universal API data access is made easier, therefore achieving higher data utilization. The system is compared with traditional pure relational database management system (RDBMS), especially in regard to the performance for ML and AI applications. Traditional RDBMSs do not deliver the data fast enough to allow real-time data provisioning of defect metadata and images to a neural network for feature extraction and comparison of these feature vectors. This presentation will show how the combination of OLAP, vector and media storage solves the problem; allows real-time image processing and defect classification; and feeds data into a casting AI that adjusts the input parameters of the casting machine to improve the production process at a large fully integrated steel mill in Germany where the system is running 24/7. The presentation will conclude that the system enables manufacturers to apply modern ML/AI applications to optimize production.

9:40 a.m.
Break

9:55 a.m.
Edge Devices and Automation
Joshua Todd, Nucor Steel–Decatur LLC
In edge computing, computations occur physically close to a source of data. As an architecture for Internet of Things (IoT), edge computing allows thousands of devices to operate in parallel, reducing central server load and network bandwidth. Additionally, such edge devices cost less per unit than centralized solutions and can scale for repeating tasks. Nucor Steel–Decatur LLC experiences success in implementing edge devices for purposes, including small-scale automation, preventive maintenance and safety. Nucor develops edge devices in-house, using a set of multi-disciplinary skills with a low cost of entry, therefore making edge computing accessible to a wider range of backgrounds.

10:35 a.m.
Ensuring Stakeholder Success: A Holistic Digitalization Foundation
David Kober, iba America
Various stakeholders that exist within an enterprise often have diverse requirements regarding the information derivation needed to accomplish their specific day-to-day tasks. With the growing complexity involved in the convergence of information technology and operational technology systems, it is important to define a firm foundation surrounding data acquisition, management and accessibility. By succeeding in this data democratization, each stakeholder achieves transparency on where to find the desired information for their respective analysis needs. The fundamental prerequisite is to acquire high-resolution data and make it readily available for multiple purposes to all stakeholders. Since the high-resolution data allows diverse views, different goals and purposes can be easily realized. This fosters collaboration among subject matter experts within their own domains. Consequently, more time and effort can be focused on the development of effective digitalization strategies. The focus of the presentation is to highlight applications in the steel industry, specifically relating to:
1) On-line monitoring (ML/AI model implementation, streaming analytics).
2) Data mining (key performance indicator (KPI)–based long-term analysis with drill-down).
3) Automated feature extraction (time- and length-based).
4) Energy optimization (efficiency improvements for planning and scheduling).

11:15 a.m.
A Foundation for Data Analytics in Manufacturing Using ibaPDA and Open-Source Machine-Learning Tools
Marcelo Cardoso, Gerdau Special Steel North America
The Gerdau Special Steel North America Fort Smith plant has expanded use of the ibaPDA system from the initial data acquisition for troubleshooting functionality to a central component of a data analytics platform. With the upgrade to a historical data server, the ibaPDA system provides the data lake foundation as well as the first level of analytics for data cleaning, filtering and process variable aggregation. Process events triggered upon data ingestion are used to automatically execute statistical analyses or machine-learning models implemented using open-source libraries for automatic notifications, anomaly detection and process diagnostics. The integration with video cameras further expanded troubleshooting capabilities.

12 p.m.
Lunch

1 p.m.
Industry 4.0 Toward Enhanced Process Performance
Elena Uchiteleva, Tenova Goodfellow Inc.
Industry 4.0, also referred as digital transformation, represents the convergence of many technologies with high impact potential, where connectivity and autonomous decision-making (artificial intelligence) play a pivotal role. This presentation focuses on how the integration of state-of-the art sensing with the Industrial Internet of Things connectivity, powerful edge computing, and advanced analytics in the cloud enable the definition of new process KPIs. In particular, the fusion of new sensing capabilities and machine learning modeling, coupled with improved information flow, allow the creation of a smart network that extracts new valuable process information. This knowledge is then transformed into process KPIs that enhance the automation technology and drive performance improvement. Such integration demonstrates the full value of the technological advancement generated by Industry 4.0. This contribution will describe the strategy and path followed by Tenova to create a process smart network, supplemented by user cases in which new process KPIs were defined.

1:40 p.m.
Applied Time Series AI for Anomaly Detection and Diagnosis in Steel Production
Crick Waters, Falkonry Inc.
AI and ML techniques have been used to solve complex operations problems. Applying ML and AI for anomaly detection and diagnosis at scale, however, has been a significant challenge. This presentation discusses how Falkonry's time series AI platform leverages ML/AI for automated detection and diagnosis of equipment in steelmaking. This methodology is scalable across use cases without the need for data scientists. Precedent detection of novel equipment conditions provides insight to maintenance operations that otherwise would have been missed. Such insights lead to proactive maintenance interventions, thus avoiding loss of production due to unexpected downtime events.

2:20 p.m.
Production Increase and Energy Saving by Superheat Prediction Through AI Digital Autoheat Model
María Luisa Argáez, ECON Tech S.A. de C.V.
The steelmaking process consists of several stages. In the first stage, steel is melted in the electric arc furnace (EAF). It is then adjusted in the ladle furnace (LF), and unwanted gases are eliminated in the vacuum degasser. Finally, the steel goes from the tundish to the continuous casting machine. In each stage of the process, as well as during its transfer between processes, heat temperature loss is inevitable, and the time in each stage and the transfer time varies according to grade steel and operational features. For this reason, the steel must be superheated so that it reaches the optimum temperature for the solidification process. However, this superheat tends to be given by experience and many times the operator must wait for the temperature measurement in the tundish of the actual heat to make adjustments with respect to the heat, not giving adequate superheat and having to adjust the speed of the machine, which may affect the quality of the product. The objective of this model is to predict the superheating that must be given to the liquid steel in the LF in such a way that the heat arrives in the tundish with the optimal temperature and time, applying data analytics and artificial intelligence through digital tools. By optimizing the control process, an improvement in steel quality, and avoiding superficial and internal defects and material waste, a production increase in the LF of between 7.5% to 8.8% and energy savings in the LF of between 1.59% and 1.86% can be realized.

3 p.m.
Break

3:15 p.m.
Reheating Furnaces – AI-Driven APC Optimization
AJ Alexander, SORBA.ai
Reheating furnaces are used in metallurgical processes in order to bring raw materials up to an adequate temperature for plastic deformation to be achieved. In steel manufacturing, these machines typically heat the billets up to a temperature of approximately 1,200°C before they are processed in the rest of the rolling mill. This process is highly controlled as the heating process is material specific and vital to achieving a good quality final product; failure of this system would result in a catastrophic loss of quality for the manufacturer. Additionally, the furnace has a high gas consumption and as such, increasing the efficiency of the heating process has the potential for large cost savings. Savings in this system are likely possible since the furnace utilizes different heating zones for the billets as well as the potential for low energy input times when the furnace needs only to maintain temperature. In this application, advanced process controls (APCs) have been utilized to increase the efficiency of the heating process with the goal of reducing gas consumption.

3:55 p.m.
Producer Panel Discussion
Panelist: Marcelo Cardoso, Gerdau Special Steel North America

5 p.m.
Reception

SCHEDULE OF EVENTS

Wednesday, 16 March 2022

7 a.m.
Breakfast

8 a.m.
Keynote Lecture
Rob Oldroyd, Nucor Steel Decatur LLC

8:50 a.m.
Development of a Prototype Digital Twin Solution for Continuous Casting
Kyle Toth, Purdue University Northwest, Center for Innovation Through Visualization and Simulation
Digital twins are becoming increasingly viable across many industries and are set to play a very impactful role in Industry 4.0. However, there are few good examples of practical implementation in many industries. The implementations that do exist typically have very limited functionality, or are mostly theoretical in design. As digital twins gradually get better, we will get closer to seeing the short- and long-term benefits from their incorporation into the workflow. A project was funded by the AIST Foundation Digital Transformation for Steel Manufacturing Grant to further develop a prototype software to provide a digital twin solution to incorporate different information and features from across many different casting human-machine interfaces (HMIs), combining them into one concise interface that can be modular. The digital twin functions to allow browsing of off-line and live database data to review both current and historic data in order to understand the conditions leading up to failure scenarios and other quality issues that are actively monitored for maintenance tasks, such as cooling, drive roll information, calibration data, casting throughput and many others. The resulting digital twin solution can be modified for many other processes outside of casting as well. The project work is carried out by a team of students and staff at the Center for Innovation Through Visualization and Simulation at Purdue University Northwest with industry mentors from Cleveland-Cliffs Burns Harbor.

9:30 a.m.
Condition Evaluation as Basis for Digitalization – Use Cases and New Analysis
Johannes Leipold and Benjamin Zimmerman, SMS group Inc.
For decades, condition monitoring has been an established, highly reliable means of monitoring the condition of machines and plants and preventing unplanned downtime. However, new analyses are constantly being developed to look into the condition of machines in even greater detail in order to get to the bottom of phenomena that were previously difficult to detect (e.g., spindle knocking). In addition, new methods of sensor technology open up new possibilities, even in components that were previously difficult to monitor (e.g., acoustic emission for monitoring slowly moving parts). Furthermore, the new methods of digitization and big data analytics are additional accelerators for the change from pure condition monitoring to condition evaluation, respectively predictive asset health (e.g., novelty detection). This presentation shows by means of practical examples that these technologies have left the concept stage and have already proven their industrial suitability in practical operation.

10:10 a.m.
Break

10:30 a.m
Neural Nets at Nucor Steel-Decatur LLC
Bryan Petrus, Nucor Steel–Decatur LLC
At Nucor Steel–Decatur, artificial neural nets have been used in rolling mill setups since the steel mill started up in 1997. As technological improvements sped up training and increased the computational sophistication of neural nets, the uses have expanded to more complicated applications, including property prediction and process optimization. Much of this has been done with locally developed or freely available source code. This presentation covers an overview of this history of neural nets at Decatur, lessons learned and plans for the future.

11:10 a.m.
Machine-Learning Applications in Alloy Optimization
Igor Nikiforovski, Quad Infotech Inc.
There has been a recent breakthrough in the use of newer machine-learning techniques to tackle steel manufacturing challenges. One important use case is the prediction of physical properties of steel based on chemical concentration and relevant process parameters. This use case is further extended by Quad Infotech Inc. and Nucor Steel–Utah to optimize for alloy consumption cost while meeting chemical and physical quality specifications. An application has been designed to aid meltshop operators with alloy additions, allowing for shop floor integration of machine-learning tools.

11:55 a.m.
Lunch

1 p.m.
Machine Vision, Leveraging Artificial Intelligence to Solve Common Tasks in the Metals Industry
Enrico Plazzagna, Danieli Automation
Digitalization and artificial intelligence can support an easier and simpler metals industry. Nowadays, vision-based applications are globally reckoned as a new trend in the steelmaking industry, being utilized in a wide range of situations thanks to their advantages, such as contactless operation mode, quickness of response and quality of measurement, coupled with the reduced need for human intervention and, thus, error. A wide range of solutions has already been developed using deep learning and machine learning to significantly expand machine vision capabilities including profile detection, surface inspection or robot guidance but also scrap classification or marking identification. A perfect example of artificial vision application is the bar counter, adopting artificial vision technology to execute an essential task: counting the bars in a bundle, with an accuracy exceeding 99.9%. The system is natively integrated with the automation systems level 1 and 2 for setting the number of bars per bundle. This task is improving plant efficiency, reducing time losses and production stops, and eliminating the encumbrances for in-line installations.

1:40 p.m.
Neural Network Technologies for Visual Tracking
Gianluca Maccani, Polytec USA
In the steel industry, it is almost impossible to apply adhesive labels, radio frequency identification and other technologies, commonly used in other industries, to track the products. The current practice is to rely on sensors and logic to suppose the position of the products during the process. Machine vision and neural network technology can finally solve the common issues of the current tracking systems; the visual recognition of dimension, color, shape and other factors during the movements of the product dramatically increase the reliability and reduce potential mismatch and claims, benefitting quality and productivity.

2:20 p.m.
Application of Micro-CT 3D Scan Technique to Investigate As-Cast Slab Defects
Hongbin Yin, ArcelorMittal Global R&D
During continuous casting, cracking defects can occur at various locations in slabs for many reasons. The initiation and propagation of some defects can be hardly explained. Hence, in some cases, examining the 3D structure of these cracks can be very helpful to find the source and solution. In this paper, a micro-CT scanning device with a resolution of 60 micrometers was used on a couple of slab cracking cases. The 3D structure of the cracks was fully digitized and further incorporated with the traditional metallography methods. This work will demonstrate how to use the new tools to understand the crack formation. Further work will use AI to link 3D CT scan to casting parameters and casting models to solve cracking problems at the casters.

3 p.m.
Break

3:15 p.m.
ARMSS: Augmented Reality Maintenance and Safety Simulator
John Moreland, Purdue University Northwest
Lockout-tagout-tryout is a safety procedure used to prevent injury and fatality from the accidental discharge of hazardous energy when performing maintenance on industrial equipment. In the steel industry, many maintenance procedures involve multiple locations, multiple pieces of equipment and multiple lockout points. Printed procedures are typically used to document and guide personnel through lockout procedures, but complexity and/or unfamiliarity with a system can cause confusion and lead to incomplete or incorrect lockouts, which can result in injuries or fatalities. The Augmented Reality Maintenance and Safety System (ARMSS) is a research project aiming to use augmented reality to assist personnel conducting lockout-tagout-tryout procedures and reduce incomplete or incorrect lockouts. The system uses a headset to display procedures, images and video to the user, while enabling them to keep both hands free to perform the lockout steps. The headset also includes camera and sensors that can be used to help document and verify steps of a lockout. Development and initial results are discussed.

3:55 p.m.
Digital Transformation Expert Panel Discussion

5:15 p.m.
Adjourn Conference