



CIVS Newsletter

March 2023

"Where Ideas Become Reality"

Issue 33



CENTER FOR INNOVATION THROUGH
VISUALIZATION & SIMULATION

PURDUE
UNIVERSITY
NORTHWEST



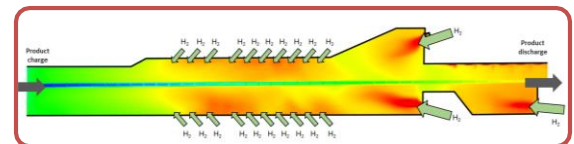
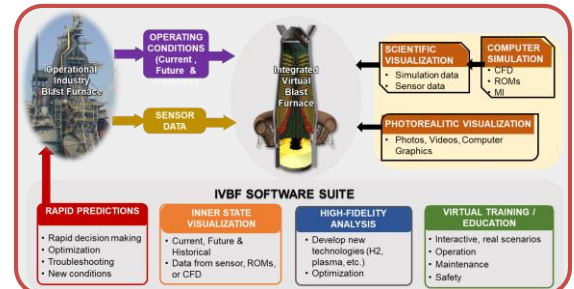
2200 169th Street
Hammond, IN 46323

219.989.2765
civs@pnw.edu
www.pnw.edu/civs



CIVS Helps Steel Industry Tackle Decarbonization Issues

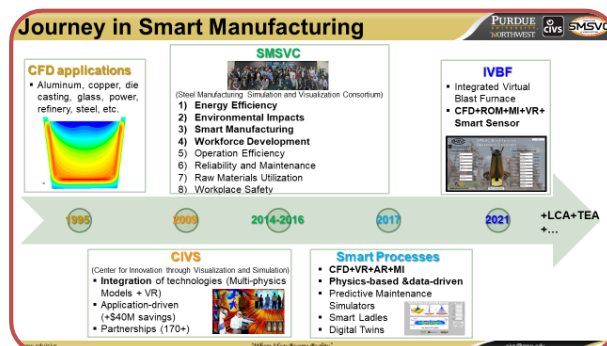
[The Times of Northwest Indiana](#) recently covered CIVS projects and how researchers use cutting-edge digital tools for innovation with industry partners to tackle the industry's biggest issues, like decarbonization. The article highlighted collaborative efforts between CIVS and SMSVC member companies. Examples include the physics-based and data-driven integrated virtual blast furnace (IVBF) project, hydrogen utilization in the blast furnace, reheating furnace, and boiler, as well as AR and VR training/education applications.



The article included a quote from CIVS Research Associate Professor Dr. Tyamo Okosun: "We know also blast furnaces aren't going away. We can't just replace them. So we need to figure out how to reduce the emissions. That's energy efficiency. That's carbon capture. That's using hydrogen. That's electrification. There's multiple methods." [Read more...](#)

CIVS Director Presents at National Academies Smart Manufacturing Workshop

Dr. Chenn Zhou was invited to be a panelist at the Workshop on Broader Impacts of Smart Manufacturing on March 7th in Washington DC. This was organized by the National Academies of Science, Engineering, and Medicine and sponsored by the Department of Energy. During the workshop, Dr. Zhou made a presentation on "Impacts of Smart Manufacturing on Sustainability", which highlighted her journey in Smart Manufacturing since 1995, with project examples and their impacts on energy efficiency, decarbonization, process operation and maintenance, and workforce development in steel and other industries. She concluded her talk by summarizing recommendations for developing and implementing Smart Manufacturing technologies from SMSVC board members. She also actively participated in the collaborative Q&A session. [Read more...](#)



Gerdau Technical Manager and Staff Discuss Collaborated Projects at CIVS



Technical managers and staff from Gerdau visited CIVS on February 2nd. Discussions included collaboration projects to investigate the behaviors of Gerdau's reheating furnace to improve the furnace operation and productivity, as well as applications of CIVS simulation and visualization capabilities for hydrogen utilization in a reheating furnace. [Read More...](#)

AIST Energy & Utilities Technology Committee Meets at CIVS

The AIST Energy & Utilities Technology Committee members had their Spring 2023 meeting at CIVS on February 15th. The committee meeting topics included planning the Steel Mill Combustion and Thermal Systems



in March and AISTech2023 in May. CIVS also gave an overview of CIVS & SMSVC projects and technologies. Examples included Hydrogen Utilization in Blast Furnaces, Reheating Furnaces, and Virtual Training. [Read More...](#)

NSF RET Summer Program Returns



CIVS will host the 3rd NSF RET Summer Program on June 12th for 6 weeks. High school and community college teachers will be selecting 20 from the 27 applicants to conduct research in smart manufacturing and to make virtual education simulators. [Read more...](#)

Virtual Die Casting Simulator Disseminated to NADCA Members

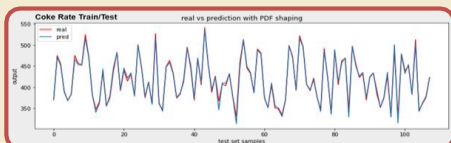
CIVS delivered the final version of the Virtual Die Casting Simulator for NADCA members. It allows operators to practice common and abnormal situations for operation and maintenance to improve casting quality, energy efficiency, and safety. It can be used on Meta Quest 2 and PC. [Read More...](#)



A New Efficient Blast Furnace Model Presented at Digital Transformation Forum



Our research on "A Multi-Input & Output Model for Blast Furnace Operational Guidance Using a Pre-generated CFD Simulation Dataset" was presented by Professor Tyamo Okosun at the 2023 AIST Digital Transformation Forum for the Steel Industry in Pittsburgh, PA. This research uses machine learning and a database of CFD results to develop a Reduced-Order Model (ROM) for operators and engineers to quickly perform "what-if" calculations on their blast furnaces. The new ROM can make predictions in a few seconds based on multi-physics and high fidelity CFD data. This is a part of a large collaborative project to develop an Integrated Virtual Blast Furnace sponsored by the Department of Energy. [Read more...](#)



Virtual Flood Simulator Taught in Civil Engineering Hydrology Lab

About 20 PNW Civil Engineering students used the virtual flood simulator in a Hydrology lab in the CIVS Immersive Theater on March 7th & 9th. The virtual lab helped students learn flood mitigation strategies by exploring interactive 3D flood events of NW Indiana. The simulator was created under a NSF grant about 10 years ago. This experiential learning takes place every year. [Read more...](#)



Weekly Skills Seminars for Students

CIVS hosts weekly seminars for students to develop both technical and soft skills. Topics included tools for literature reviews and reading journal papers presented by CIVS PhD student Sam Nielson. [Read More...](#)

CIVS Intern Charlene Benoit also talked about effectively communicating and presenting research findings. [Read More...](#)



Student Success Story: Charlene Benoit

Communications Intern, Charlene Benoit was recognized as an Outstanding Woman of PNW as part of PNW's celebration of Women's History Month. She was recognized for her several leadership roles within student organizations and her current and previous student worker positions on campus. [Read more...](#)



CIVS Students Welcomed by AIST Midwest Chapter Industry Leaders

CIVS students and faculty regularly attend the AIST Midwest Chapter Monthly Dinners in Merryville, IN. At the beginning of each dinner, the Chair invited all the PNW students to stand up with a big round of applause by over 300 attendees. Students have enjoyed the networking opportunities and learned various topics from keynote presentations. These included "Hydrogen Steelmaking" by Dr. Pravin Mathur, Executive Director of Metals, Combustion & Energy at Linde in January ([Read More...](#)) and an overview of AIST and ArcelorMittal's New Technologies" by Keith Howell, Chief Operating Officer of ArcelorMittal North America and AIST President 2022–2023 in February ([Read More...](#))



Student Success Story: Yanan Song

Congratulations to Yanan Song who was recently hired as a Research Engineer at ArcelorMittal Global Research in East Chicago. Yanan worked at CIVS as a Research Assistant and Associate Research Engineering during and after his Master's of Electrical and Computer Engineering degree. Yanan participated in several projects to develop and implement AI tools that improve energy efficiency, reduce CO₂ emissions, and increase productivity. These collaborative projects include the Smart Ladle and Integrated Virtual Blast Furnace. ArcelorMittal is a Charter member of the SMSVC. [Read More...](#)



Prototype Sensor for Casting Rate Tested at #7 Blast Furnace at Cleveland-Cliffs Indiana Harbor Plant

On March 1st, Purdue Northwest and Purdue University-West Lafayette research team members visited the Cleveland-Cliffs plant in Indiana Harbor to test an upgraded prototype of imaging sensor for casting rate of Blast Furnace #7. Discussions were also made on the results of CFD simulations. This visit supported efforts on the Integrated Virtual Blast Furnace project as well as a parallel research project for investigating high-rate natural gas injection at Cleveland-Cliffs facilities. [Read more...](#)



SMSVC NOTES

Annual Meeting
April 12 & 13, 2023

SMSVC Accepting New Members

SMSVC is accepting new members. If interested in becoming a member, please contact steelcons@pnw.edu

For more information on the Consortium, visit steelconsortium.org.

Groundwork Established for New Crane Simulation



CIVS researchers visited U. S. Steel Gary Works for a new crane training simulator. In order to make the simulator more authentic, photo and video reference materials were gathered. Discussions were made for learning objectives and real world scenarios. This provides the foundation for an effective customized simulator. [Read More...](#)

Site Visit for Caster Digital Twin Project



CIVS graduate and senior Design students toured Caster #1 at Burns Harbor, which provided real-world experience for them to develop a digital twin of a continuous caster. [Read more...](#)

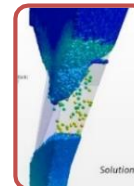
ArcelorMittal Global Reps at CIVS

ArcelorMittal global research representatives visited CIVS to discuss ongoing & future collaborations. [Read More...](#)



Presentations at AIST Scrap Supplements and Alternative Ironmaking Conference

Two presentations were made on March 8th: “Development of a Material Flow Model for Pellet Feed Systems” by graduate student John Rosser and “CFD Modeling of Melting of HBI/DRI in an AC Electric Arc Furnace” by postdoctoral researcher Dr. Orlando Ugarte. [Read More ...](#)



Facts and Impact (Since 2009)

- \$40+ million savings for companies
- \$35,900,000+ in external grants and contracts
- 170+ external organizations collaborated with CIVS
- 420+ projects
- 690+ national and local news
- 1,960+ students employed and mentored
- 11,600+ students used CIVS for virtual labs
- 200+ Purdue faculty and staff collaborators
- 295+ student awards and grants (globally, since 2011)
- 36,200+ local, national and international visitors