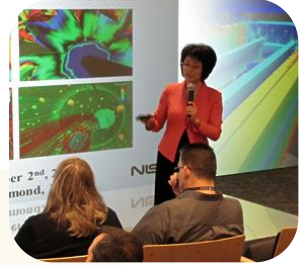




CIVS Leading the Launch of a National Steel Consortium

CIVS Director, Chenn Zhou, is directing the new nationwide industry-led Steel Manufacturing Simulation and Visualization Consortium (SMSVC) to improve the competitiveness of the American steel industry. The consortium began development in 2014 through a National Institute of Science and Technology AMTECH Planning Grant, and is now enrolling charter members across the value chain of the steel industry. Major steel producers and suppliers that have already enrolled include: AK Steel, ArcelorMittal, NUCOR, Steel Dynamics Inc, SSAB, and Riverside Refractories Inc. Several others are in the enrolling process.



The consortium charter member will have opportunities to be involved in the project selection process in December 2015. Benefits for charter members include: discounted membership fees, fixed membership fees for three years, and guaranteed enrollment. Other benefits for members include: industry-led decision-making, accelerated innovation, value-added solutions, direct access to students, rapid access to research results, collaborative efforts and combined resources, and leverage from CIVS technologies and funding agencies.

"I applaud the leadership of Director Zhou and Purdue University Calumet for the investment of their time and ability to ensure that our domestic steel industry remains the most technically advanced in the world. These are difficult days for the American steel industry, but the actions of this initiative give me confidence that our institutions of higher learning, our domestic workforce, and our producers remain committed to manufacturing steel in America." - Congressman Pete Visclosky

The consortium will launch its first group of projects on January 15, 2016. Under the supervision of faculty members and industrial engineers, Purdue University Calumet students will apply technologies of the university's CIVS research facility to conduct research projects selected by the consortium members. Encouraged by early work of the consortium, the U.S. Department of Energy is sponsoring a pilot project involving CIVS and Lawrence Livermore National Laboratories in California to harness high performance computing power that increases simulation resolution and decreases computation time.

Companies interested in enrollment can get information and begin enrolling online at www.steelconsortium.org. For more details, contact us by phone at +1 (219) 989 2765, via email at SteelConsortium@purduecal.edu.

CIVS Collaborates with Lawrence Livermore National Lab on Steel

The U.S. Department of Energy Advanced Manufacturing Office is supporting a pilot project for CIVS and the Steel Consortium to work with Lawrence Livermore National Lab. The goal is to develop the methodologies and technical capabilities to integrate advanced simulation, visualization, and high performance computing (HPC) technologies to provide innovative solutions to energy-intensive manufacturing processes. Specifically, the pilot project will investigate the best code architecture for integrating HPC with multi-physics simulations and visualizations as well as demonstrate how HPC could be applied to improve time-to-solution for representative test problems such as a blast furnace and a ladle. The project will benefit the steel industry by enabling more detailed simulations to take place in significantly less time. Since 2009, CIVS has collaborated with over 90 organizations including companies, universities, and K-12 schools.



CENTER FOR INNOVATION THROUGH VISUALIZATION & SIMULATION



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Selected Examples of Funded Projects

Since 2009, CIVS has received 93 grants and contracts, bringing in over \$11 million to the University.

Project Title	Sponsor
Interactive GIS Based Technology for Regional Planning and Economic Development	Alliance for Reg. Dev.
The Virtual Blast Furnace: An Integrated High Performance Computing Modeling, Simulation and Visualization Capability for Steel Manufacturing	Lawrence Livermore National Laboratory
Blast Furnace (IH7) Fuel Injection Optimization	ArcelorMittal
CFD Modeling of a Ladle with Top Stirring Lance	ArcelorMittal
Structural and Thermal Analysis of Alumina Refinery Ductwork	Alcoa
CO Boiler 12B-2 CFD Study	Citgo
Numerical Optimization of a QBOP Vessel for Minimizing Kidney Formation	U. S. Steel



Blast Furnace Simulations and Visualizations continue to be developed by CIVS for optimization, troubleshooting, and virtual training.



A Suite of simulators for wind energy education was developed by CIVS through a grant from the U.S. Department of Education.

New Developments for Digital Philosophy Education

CIVS has been working with Dr. Howard Cohen to develop digital games for philosophy education. The first game, titled Distributive Justice, converted a pencil-and-paper classroom exercise into a 3D classroom game prompting students to discuss justice and fairness. The game was piloted in several classrooms, and initial surveys showed its effectiveness that has prompted the development of a variant of the game, Distributive Justice: Justice for Rocky Flats. This variant has been used by high school AP students learning about the impact and possible remediation of the consequences of radioactive waste on generations of residents in a Colorado town. Two additional games based on the writings of philosopher René Descartes and Plato are in the testing phase. Distributive Justice, Descartes and Plato's Crito will be used in the upcoming fall semester at Purdue Calumet, with other universities also expressing interest. The games are being copyrighted and information to access them is available online [here](#).



ME Professor Collaborates with CIVS to Research New Ways to Teach Materials



Dr. Harvey Abramowitz has been collaborating with CIVS to develop new methods for teaching students about ternary phase diagrams using virtual reality and related technologies. The focus has been on the visualization of liquidus surfaces of ternary alloys as well as slag systems related to iron and steel making funded by a FeMet grant from AIST and the AISI.

The work was recently highlighted at AISTech 2015, where graduate student Huanan Shen presented the latest developments using mobile devices, augmented reality and 3D printed models to visualize and actually feel the liquidus surfaces of a variety of ternary nonferrous alloy systems. Other collaborators include Michael Roller from CGT, and Dr. Howard Piolet of ArcelorMittal Research.

Congressman Pete Visclosky Visits CIVS for Collaborative Canstruction Project



Congressman Pete Visclosky visited CIVS this summer to speak with youth about hunger. In it's second year of collaborating with United Way for Canstruction, CIVS developed a new interactive software that allows area kids to learn about 3D modeling and build large-scale structures out of unopened cans of food. The software was used by 8 groups of students this summer to develop super-hero themed canstructions during a 3D design camp at CIVS. The teams used the designs to build the canstructions at Southlake Mall in Northwest Indiana. The food was later donated to local food pantries.

Indiana Commission for Higher Education Samples Virtual Learning

A group of commissioners from the Indiana Commission for Higher Education (ICHE) visited CIVS on August 12 to learn about the virtual learning tools being developed for academia and industry. The group experienced the virtual blast furnace used by the steel industry for training, and viewed multiple simulators that CIVS developed for wind energy education through a grant from the U. S. Department of Education. Commissioners also had hands on experience trying Google Cardboard and other devices used for bringing virtual reality into the classroom.



High Rate Natural Gas and Lance Design Research Benefits Steel Companies



In July, CIVS director, staff and students traveled to Lake Erie Works in Canada to present research findings to U. S. Steel Canada and the ESM Group. The U. S. Steel project focused on modeling high rate natural gas injection in the Lake Erie Works blast furnace. Different lance designs were simulated to determine their impact on furnace operation. Several scenarios of varied production rates were also examined to determine the relationships between furnace production rate and operating stability and optimized performance. The ESM Group project focused on conducting a comparison between the mixing qualities of different lance designs inside a steelmaking ladle.

Student Successes – Lucas Phillips

Lucas Phillips joined the CIVS research group in 2012 while working on his Master's Degree in Computer Graphics Technology (CGT). He began school at Purdue Calumet in 2006, receiving his B.S. in CGT in 2010, M.S. in CGT in 2012, and then completing another M.S. degree in Modeling, Simulation, and Visualization in 2014. While at Purdue Calumet, he taught multiple CGT courses and participated in SIGGRAPH.

At CIVS, Lucas worked on a variety of interactive 3D projects including development of 3D visualization for a Wrigley Company gum manufacturing facility, visualization for terrorism threat detection, microbiology automation facility planning and 3D visualization, Interactive Blast Furnace for Steel Industry Training, 3D animations of steel industry processes, and 3D modeling for NSF funded simulator for auto-industry technicians. He went on to accept a position as instructional designer for Sullair, a manufacturer of compressed air solutions, located in Michigan City, IN.



Virtual Safety Training Priority is Top on Consortium Roadmap



Safety is a top priority for the steel industry and will be the focus of several projects on the Steel Manufacturing Simulation and Visualization Consortium (SMSVC) Technology Roadmap. CIVS showcased Virtual Safety Training projects at this year's AISTech conference, using portable virtual reality and augmented reality technologies to enable more engaging learning. The Roadmap outlines a strategy to leverage advanced technologies in key focus areas to help make the American steel industry more competitive.

Steel Manufacturing Simulation and Visualization Consortium (SMSVC) Technology Roadmap. CIVS showcased Virtual Safety Training projects at this year's AISTech conference, using portable virtual reality and augmented reality technologies to enable more engaging learning. The Roadmap outlines a strategy to leverage advanced technologies in key focus areas to help make the American steel industry more competitive.

Korean Students Learn Research at CIVS

A group of four Korean undergraduates from Chonnam National University studied with CIVS for one month this summer, learning about simulation and visualization techniques. The students used computational fluid dynamics software to simulate chemical reactions taking place in a steel industry reheating furnace. They also used visualization software to interact with simulation results in virtual reality. Students also toured facilities at Tri-State Automation and took part in Purdue Calumet's English Learning Program. The summer program was arranged by the Purdue Calumet Office of International Affairs. CIVS Director, Chenn Zhou, presented lectures in Korea this summer.



CIVS Hosts Career Camp to Teach and Motivate Northwest Indiana Students



CIVS partnered with READY NWI and the Works Council of Northwest Indiana to host a five-day camp for seventh through ninth graders to learn about careers in Northwest Indiana. Students took part in hands-on activities with advanced technology including 3D printing and virtual reality, as well as interactive 3D projects dealing with steel manufacturing, power generation and wind power. Students also interacted with industry professionals from Tri-State Automation, ArcelorMittal, IBEW, and NIPSCO. The companies made presentations, exchanged ideas and information with students and answered questions about careers in industry.

CIVS Facts and Impacts

The following are some CIVS highlights since 2009.

- \$38++ million savings for companies
- 3,400+ students used CIVS for experiential learning and virtual labs
- 90 external organizations collaborated with CIVS
- 139 completed projects
- 111 technical publications
- 188 national and local news
- 723 graduate and undergraduate students employed and mentored
- 82 Purdue Calumet collaborators
- 44 student awards
- 16,700+ local, and international visitors since October 2011
- \$11+ million in external grants and contracts brought in to the University

Office of Institutional Advancement – Giving to CIVS



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