STEEL FOUNDERS' SOCIETY OF AMERICA

2023 T&O Workshop

2:00 p.m. to 6:00 p.m. Wednesday, December 6th

De-Mystifying Materials: From Alchemy to Metallurgy

John D. Galuardi - Colorado School of Mines/Naval Surface Warfare Center, Carderock Division

There is a concept taught in materials science called the "Materials Tetrahedron", a device used to relate processing, properties, structure, and performance to each other. This tetrahedron, though comprised of what seems like a collection of "buzzwords", is in fact the core philosophy behind materials engineering and one that warrants exploration and understanding. This session intends to explore this philosophy, discussing things like "the Illusion of Scale", how nanoscale features affect macroscale performance, and how the re-examination of "that's the way we've always done it" thinking can lead to revolutionary new ideas and unexplored ways to improve how we approach metallurgical problems and metals production. A presentation and town hall-style discussion led by John D. Galuardi and Dave Poweleit will open up a conversation on the future of casting and how we can get there.

Next Generation Manufacturing (Industry 4.0) Tabletops

Phil Deierling – Deierling Engineering

Frank Peters, David Eisenmann, Landon Getting and Matt Janowicz – Iowa State University

Jerry Thiel, Nate Bryant and Sam Manternach – University of Northern Iowa

Tory Wendlandt (SFSA) and Hannah Blum – University of Wisconsin-Madison

This session will feature hands-on interaction with steel foundry Industry 4.0 research:

<u>Job Shop Automation</u>

1. Mold wash (ISU) - Collaborative Robots (Cobots) are opening opportunities for lower cost and easier to deploy automation solutions. Everyone can become a robot programmer to 'write' code for a cobot to complete a simulated mold wash spraying application and deploy this program in real time.
2. Arc-air & grinding (ISU) - Presentation on flexible automation solutions for both arc-air and grinding with operator directed automation with easy to operate interfaces, and the robot doing the hard manual work. This will be an opportunity to see results and videos and discuss these automation solutions and the next steps.
3. Robot training (UNI) - Offline robot programing based on part model can be completed quickly.

<u>Sensors Technology</u>

4. IoT (UNI) - Demonstrating low-cost hardware and open-source software for the industrial Internet of Things. This will include constructing simple sensor packages with prototype boards and connecting them to a central computer which acts as a database. The sensor data populates charts in real time and saves the data for future analysis. A variety of sensors will be available for demonstration and the low-code no-code platform will also be explained.

5. Part identification (UNI) - Demonstrating how castings can be scanned.

Quality 4.0

6. MPI (ISU) - Mag Particle Inspection is a powerful tool but is subject to several sources of measurement error. If there is not adequate magnetic field strength and direction and surface roughness, then the ability to find an indication is lost or hampered. However, this industry makes complex shaped parts so creating an adequate magnetic field everywhere is not easy. Interaction with real results that may challenge one's understanding of the process.
7. PAUT (ISU) - There has been an increasing interest in the use of Phased Array Ultrasonic Testing as an alternative means of inspecting cast steel parts. The future of NDT will become more and more dependent on the automation as labor shortages continue. Preliminary automation is being developed by creating ultrasonic "C-Scans" using a two-dimensional glider system for PAUT.
8. DART (Deierling) - Quality inspections are crucial to understanding whether or not a manufacturing process is meeting design and process expectations. However, quality inspections tend to be tedious and require an experienced inspector to make reliably consistent assessments. Quality inspectors in a typical foundry must mark on a casting the locations of anomalies and log or sketch the approximate location. Defect Automated Recording and Tracking maps the position of markings, records the information to a database and visualizes the quality history through heatmaps, plots, and histograms. Demonstration of the software, requirements and discuss the accuracy of the system. Use the software and provide necessary feedback on the user interface, performance, and suggested future features.

ARtisan

9. AR (Wisconsin) – Augmented Reality provides an opportunity to assist artisans in manufacturing steel castings with wearable technology. There are a multitude of uses including process instructions, data entry, remote support, process optimization, and data to develop deep learning. Demonstration of smart glasses to see the technology functions and imagine the range of applications that are possible.