Technische Hochschule Brandenburg
University of Applied Sciences

Japan Excursion 2024

大阪大学 OSAKA UNIVERSITY

DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service

JWRI Joining and Welding Research Institute Osaka University

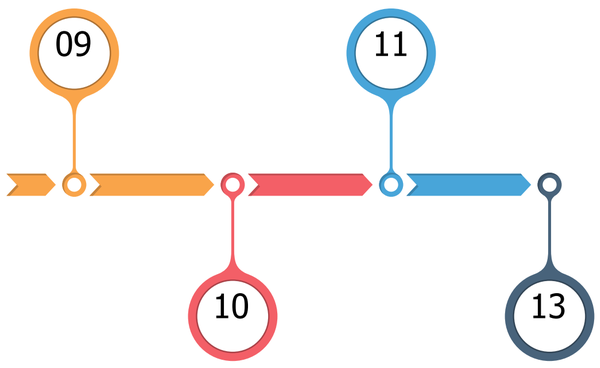
KOBELCO

Joining Technologies Experiments | 接合技術実験

Mariana Cabrera, Luis Moraila, José Pablo González, Akshay Shahane, Prof. Sven Goecke

Project Timeline

December 2024



December 9th, 2024 - Osaka University visit, emphasizing the Joining and Welding Research Institute (JWRI) laboratories. Analyzed the execution of multiple testings by Naca's high speed cameras.

December 10th, 2024 - Took part of a Prof. Goecke's masterclass in arc welding, as well as some other presentations from his Japanese colleagues.

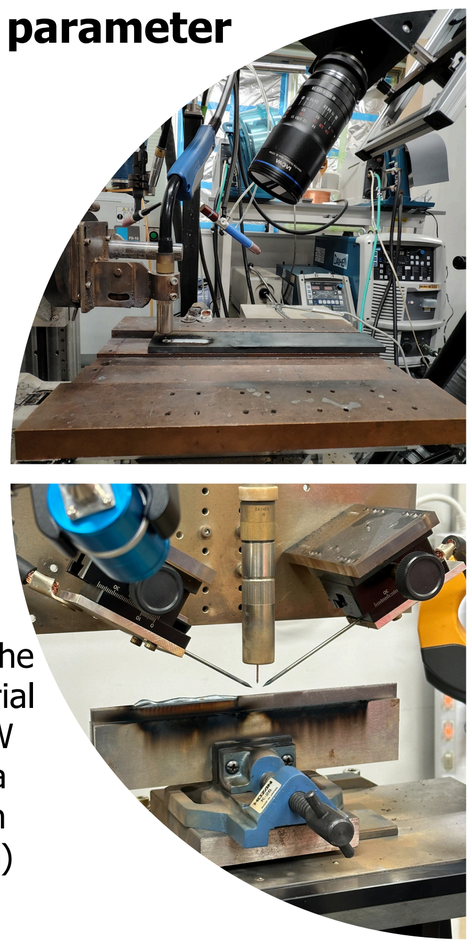
December 11th, 2024 - Went back to the JWRI facilities to witness welding experiments performed by Osaka University's students.

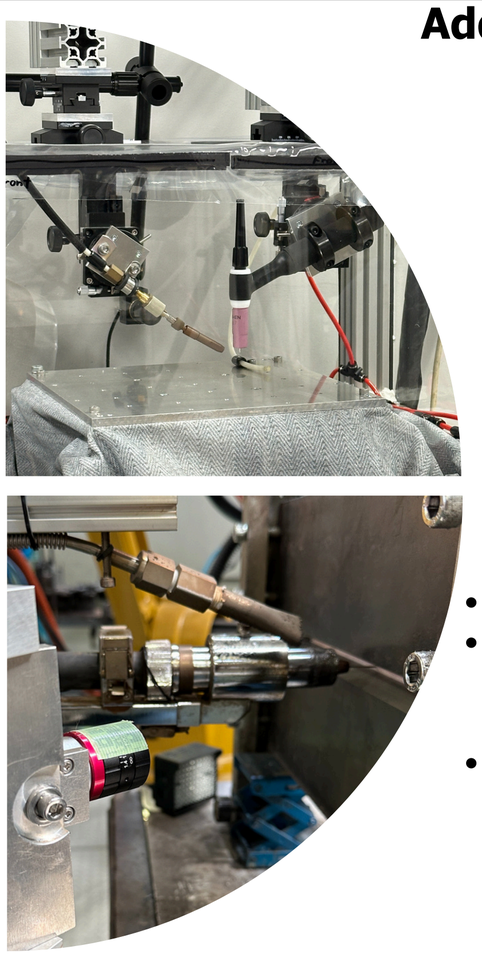
December 13th, 2024 - Visited a Japanese steel supplier company named Kobelco, and analyzed their products, materials and welding techniques.

Experiments

Optimizing High-Speed Cameras parameter for Precision Welding Recording

- Experiment in GMAW and TIG.
- Testing of Naca high speed cameras.
- Analysis of temperature on melting pools.
- Usage of different camera filters.
- Variation of Argon and Helium gas.





Visualization of internal flow of melt droplets in gas metal arc welding

- Experiment in PAW.
- Usage of two tungsten electrode for arc lenght control.
- Internal flow velocity increases with the increase of current and the arc expansion
- Aiming to improve the control of the material deposition on GMAW
- Implementation of a high voltage ignition (contactless ignition)

Additive Manufacturing process by arc plasma driven metal jet

- Experiment in TIG.
- Plasma arc source, metal feed system, and shielding gas.
- Worked as a 3D printer, with moving axes.
- Low heating improves the the product quality
- Used in a sealed chamber.

Welding Parameter Adaptation using AI

- Experiment in GMAW.
- Real time melting pool size and shape quality analysis.
- Actual industrial applications: ship hulls
- AI in charge of adjusting welding paramets such as travel speed and arc lenght.
- Better control of the weld bead penetration

Welding experiments results

Main challenges and limitations

- Porosity
- Weld defects
- Slag formation
- Wire feed issues
- Weld pool control
- Absence of welding gas
- Material surface

Important parameters in welding

- Current
- Voltage
- Speed
- Type of used gas (if needed)
- Shielding gas composition
- Gas flow rate (if needed)
- Contact tip to work distance
- Base Material Preparation
- Filler material
- Working angle
- Arc length

References

[1] Y. Ogino, S. Asai & Y. Hirata, „Numerical simulation of WAAM process by a GMAW weld pool model“, 2018
[2] S. Eda, Y. Ogino, S. Asai & Y. Hirata, „Numerical study of the influence of gap between plates on weld pool formation in arc spot welding process“, 2018
[3] M. Tanaka, H. Terasaki, M. Ushio, JJ. Lowke, „A unified numerical modeling of stationary tungsten-inert-gas welding process“, 2002

Kobe

Kyoto

Osaka