Session on

Digital Twin Ocean Engineering & Equipment Ⅰ (OE 1)

Tuesday, October 15th 2024

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Milan Time	Beijing Time	Agendas
14:00	20:00	**OE1-1** Research on Digital Twin of Self elevating Platform Bo ZHOU
14:30	20:30	**OE1-2** Digital Twin Model-driven Adaptive Welding of Curved Ship Blocks Cheng LUO
15:00	21:00	**OE1-3** Forming Difficulty Evaluation of Line Heating for Complex Curved Ship Plate Shun WANG
15:30	21:30	**OE1-4** Optimal Design of Fixture Layout for Compliant Part with Application in Ship Hull Assembly Process Changhui LIU
16:00	22:00	**OE1-5** Digital Twins for Modeling Flight Environment Processes in Aerospace Spacecraft Design Vsevolod V. KORYANOV
16:30	22:30	**OE1-6** Deep Reinforcement Learning for Optimizing fleet Management in Shipbuilding: A Comparative Study Xiaolei XIANG
17:00	23:00	**OE1-7** Modeling the laser welding during ship building Lu WANG
17:30	23:30	**OE1-8** Deep Learning Analysis of Spray Particles Characteristics for Gas Turbine Engine Wenjing XING

Digital Twin Ocean Engineering & Equipment Ⅰ（OE1）

Chair

Honggen ZHOU

Professor,

Jiangsu University of Science and Technology (China)

Co-Chair

Jinfeng LIU

Associate professor,

Jiangsu University of Science and Technology (China)

Vsevolod V. KORYANOV

Associate Professor,

Moscow State Bauman Technical University (Russia)

Xuwen JING

Professor,

Jiangsu University of Science and Technology (China)

DT Ocean Engineering & Equipment Ⅰ（OE1-1)

Bo ZHOU

Professor,
Dalian University of Technology (China)

Title:

Research on Digital Twin of Self elevating Platform

Abstract

On the basis of the initial equipment of the offshore self elevating platform, this study adds a series of sensor systems to monitor structural data and ensure the information transmission and reception functions of key monitoring equipment. Based on the completion of the monitoring system, develop a software system database and 3D display module, establish a comprehensive data acquisition and simulation calculation plan, build a digital 3D display platform for the platform structure, and realize the digital twin and intelligent application of the self elevating platform.

DT Ocean Engineering & Equipment Ⅰ（OE1-2)

Cheng LUO

Associate Professor,
Shanghai Jiao Tong University (China)

Title:

Digital Twin Model-driven Adaptive Welding of Curved Ship Blocks

Abstract

Welding path planning is vital to improve the efficiency of the robot system in welding of curved ship blocks. Common welding path planning methods is mainly depending on discrete points fitting to determine the curved seam positions in physical welding conditions, leading in both decreases of efficiency and accuracy. In this report, a deep-learning empowered-digital twin system was proposed to plan and adjust welding paths by modeling the seams positions and features during welding process. The model successfully facilitated the adaptive control of weld positions for curved seams in real time, resulting in the improvement of welding quality.

DT Ocean Engineering & Equipment Ⅰ（OE1-3)

Shun WANG

Associate Professor,
Dalian Maritime University (China)

Title:

Forming Difficulty Evaluation of Line Heating for Complex Curved Ship Plate

Abstract

To solve the problem that the lack of reference for hull plate division leads to the difficulty and low efficiency of curved plate forming, the forming difficulty evaluation of complex curved hull plate is researched. Considering the characteristics in curved plate forming process, the weight coefficient of different affecting factors on the forming difficulty of curved plate is quantified. The forming difficulty of curved hull plate is calculated. By comparing and analyzing the forming evaluation results and forming time data of curved hull plate, the rationality of the evaluation method is verified. The research can provide reference for the reasonable division of hull plate.

DT Ocean Engineering & Equipment Ⅰ（OE1-4)

Changhui LIU

Associate Professor,
Tongji University (China)

Title:

Optimal Design of Fixture Layout for Compliant Part with Application in Ship Hull Assembly Process

Abstract

In the ship assembly process, a large number of compliant parts are involved. The ratio of the part thickness to the length or the width is very small. Fixture design is a critical task in the ship assembly process due to its impact on the deformation and dimensional variation of the compliant parts. The current practice in the ship industry, the fixtures are uniformly distributed, which is non-optimal and large deformation will occur. This speech will talk about a series of studies of Prof. Liu for optimal design of fixture layout in the ship assembly process by integrating direct stiffness method and Metaheuristic algorithm, which significantly reduced the deformation of the compliant part in the ship assembly process

DT Ocean Engineering & Equipment Ⅰ（OE1-5)

Vsevolod V. KORYANOV

Associate professor,
Moscow State Bauman Technical University (Russia)

Title:

Digital Twins for Modeling Flight Environment Processes in Aerospace Spacecraft Design

Abstract

Currently, the aerospace industry is developing in almost all areas: these include near-Earth constellations of spacecraft, and the development of deep space exploration. Designing spacecraft that move in deep space is impossible without the use of digital twins. The process is complicated by the fact that it is often very difficult and expensive or impossible to create full-fledged experimental setups that simulate the process of spacecraft movement in space. The processes that occur when spacecraft move in space are sometimes very fleeting and important. In the direction of designing spacecraft, the use of digital twins is very relevant and necessary.

DT Ocean Engineering & Equipment Ⅰ（OE1-6)

Xiaolei XIANG

Associate professor,
Curtin University WASM (Australia)

Title:

Deep Reinforcement Learning for Optimizing fleet Management in Shipbuilding: A Comparative Study

Abstract

This research investigates the application of Deep Reinforcement learning (DRL) algorithms to optimize fleet management in shipbuilding operations. Three DRL models-modified Actor-Critic (AC), Prioritized Experience Replay (PER) Dueling Double Q-network (DDQN), and Proximal Policy Optimization (PPO)-are developed and accessed for their effectiveness in improving efficiency and productivity. The study compares their DRL approaches to traditional methodologies, demonstrating superior performance in enhancing operational efficiency. The findings provide valuable insights into the potential of DRL algorithms to drive intelligent fleet management and resource optimization in the shipbuilding industry.

DT Ocean Engineering & Equipment Ⅰ（OE1-7)

Lu WANG

Assistant Professor,
City University of Hong Kong (China)

Title:

Modeling the laser welding during ship building

Abstract

Metal melting and solidification is the basic process in both laser powder bed fusion and laser welding during ship building and repairing. However, the quality of the fabrication is difficult to be controlled though trail-and-error experiments due to the laser influencing factors. The high cost of experimental measurements also poses difficulties for the processing parameter optimization. To solve this tough situation, high-fidelity simulation is an effective approach to explore the mechanisms behind it and reduce the defects formation. In this report, a multi-physics thermal-fluid model, incorporating heat transfer, metal evaporation, Marangoni effect, etc., is brought up to simulate the pore formation. To optimize the process, an external magnetic field is applied to generate high intensity Lorentz force to modify the molten pool flow and adjust the grain morphology. These simulation results have been validated with advanced experiment measurements, which lays a solid foundation for further study to optimize the welding process.

DT Ocean Engineering & Equipment Ⅰ（OE1-8)

Wenjing XING

Assistant Professor,
Yamagata University (Japan)

Title:

Deep Learning Analysis of Spray Particles Characteristics for Gas Turbine Engine

Abstract

This study aims to comprehensively investigate the atomization process and characterize the spray, encompassing both ligaments and droplets, through the application of deep learning techniques. The spray, injected from a twin-fluid atomizer into a crossflow, is analyzed using a hybrid approach involving CNN-based deep-learning and image processing to detect spray particles as regions of interest (ROI). Post-analysis of the obtained ROIs involves assessing displacement, sizes, and posture (orientation) distribution of spray particles. Additionally, a novel definition is proposed to determine the average velocity vectors of spray particles. The results reveal a noticeable change in the flying direction, transitioning from predominantly horizontal angles to nearly vertical angles, especially evident with an increasing atomizing air flow rate.